JTK # 34961

OPERATOR'S MANUAL

SD1200A/B

DIGITAL RANDOM CONTROL SYSTEM

Spectral Dynamics
Scientific-Atlanta

SD1200B-1 SERIAL 54

JTK # 34961

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Spectral Dynamics
Scientific-Atlanta
P.O. Box 671 • San Diego, CA 92112 • (714) 268-7100 • TWX 910-335-2022

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CAUTION

Computer-based shaker control systems are unique in that they are designed to provide a maximum number of safety features to protect shakers and test packages. However, due to conditions inherent in any computer system, certain precautions must be observed when turning on the system to eliminate the possibility of damage to the shaker or test package.

When power is first applied to the computer, various digital devices are set initially to random states. This requires that the computer be initialized prior to being placed into operation. Typically, the first step in the initialization process is Booting" the computer.

Prior to "Booting" the computer, the gain control to the shaker system power amplifier must be set to zero.

Furthermore, pressing the BOOT/INIT switch to the INIT position while running a program will abort the program in progress and may destroy general purpose register and memory contents. It will also set the shaker drive output to zero, which may cause a transient of sufficient magnitude to seriously damage the test specimen or the shaker itself.

SECTION I
GENERAL INFORMATION

1.1 INTRODUCTION

The Spectral Dynamics SD1200 series are Digital Random Control Systems, designed to automatically perform complete vibration test sequences. They combine the speed and flexibility of a real-time spectrum analyzer (RTA) with the automatic control of a minicomputer. The basic system permits on-line editing of test and control parameters, and produces outputs which permit annotated recording of Power Spectral Density (PSD) profiles. Additionally, standard options are available to provide multi-shaker control, analog plots, digital plots, and displays on graphic terminals. The cost of multi-shaker systems is minimized by time sharing expensive elements of the total system between shaker stations.

1.2 OTHER DOCUMENTATION AVAILABLE

SD1200 documentation consists of this Operator's Manual, the Hardware Manual (Configuration Document), the RTA Instruction Manual, and applicable manuals describing vendor-supplied equipment.

Complete assembly drawings and schematics for the various Spectral Dynamics equipments included in the system, while not provided with the system, are available, and a quotation for providing these documents will be furnished by Spectral Dynamics upon request.

1.3 SYSTEM DESCRIPTION

The basic SD1200 series Multi-Shaker Digital Random Control System is designed to (1) drive and control a shaker to subject a test specimen to random vibrations predetermined by a standard spectrum of g^2/Hz values, (2) correct the resultant shaker drive signal to compensate for changes caused by the mechanical characteristics of the shaker and test specimen, (3) produce a response from the test specimen that conforms (within predetermined limits) to the content of the standard spectrum.

A maximum of 99 standard spectra may be stored in the system for shaker controls, and the number of response spectra (test profiles) that may be captured and stored is limited only by the system disk storage capacity or 99 maximum.

During a test sequence, the response of the device under test is monitored and the grms level is displayed on a LED readout. With appropriate options the system also continously monitors the shaker accelerometer signal and automatically aborts the test if predetermined safe amplitudes are exceeded.

1.4 SYSTEM COMPONENTS

1.4.1 Model SD1200A

Figure 1-1 is a simplified block diagram of the basic SD1200A system. The system consists of a 500 line RTA, Ensemble Averager, X-Y Display, System Control unit, Disk Drive, a Terminal, and a Computer. The computer, a DEC PDP 11, also houses the I/O Assemblies and the Digital Data Randomizer/Digital-Analog Converter (DDR/DAC) Assembly. These items are Spectral Dynamics products, installed in the computer. The terminal shown may be provided either by Spectral Dynamics or by the system user.

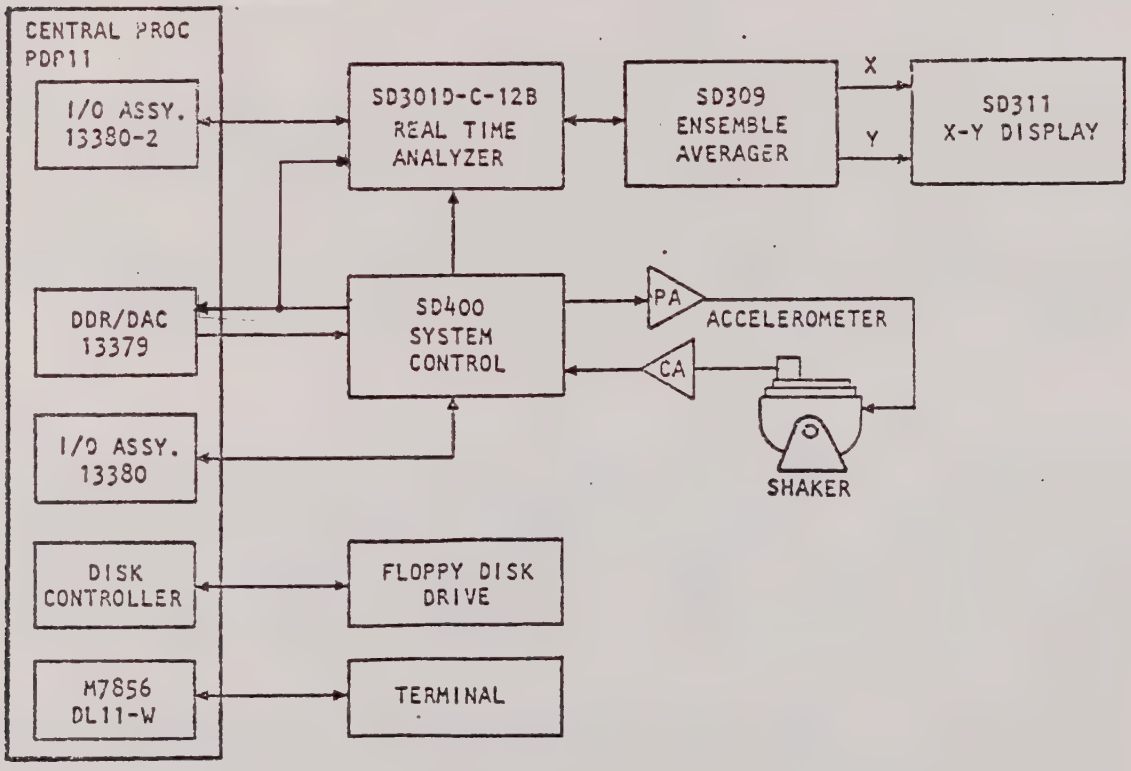


Figure 1-1. Basic SD1200A System Block Diagram

1.4.2 Model SD1200B

The major difference between the SD1200A and SD1200B system is the SD330A-78A RTA as shown in Figure 1-2. The RTA used in the 1200B system has 125 or 250 line resolution and features a built in ensemble averager and X-Y display.

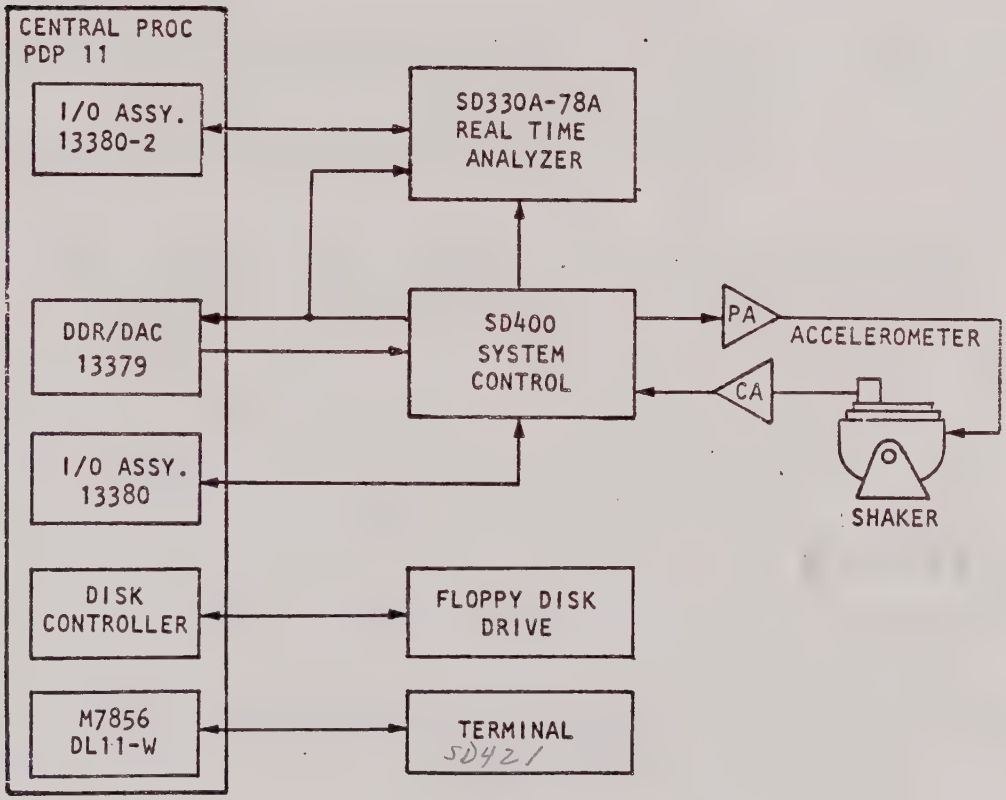


Figure 1-2. Basic SD1200B System Block Diagram

1.4.3 Cabling

Cable harness Assemblies providing all signal and control interconnections are defined by the Interconnect Drawings included in the Hardware Manual.

1.4.4 Cabinets

All system components except the terminal are installed in an equipment cabinet on standard 19-inch rack slides for easy access. A Rack Configuration Drawing is included in the System Hardware Manual.

1.5 STANDARD FEATURES

Some of the standard SD1200 features are as follows:

- Modular construction preserves every dollar invested.
- Designed for standard laboratory operations. Field expandable for Combined Environment Reliability Tests (CERT) and/or multishaker control.
- Expandable from a single basic system up to 32 stations based on the user's desires at minimum cost per add-on station.
- Simple, straightforward programmablilty and control by operators with limited skill. Once programmed, the system performs automatically or in response to panel controls.
- Real time response data is visible on any station being serviced. Data is instantly displayed.
- Profile sequences programmable with different accelerometer normalizations.
- Automatic system gain adjustments are made without use of external voltage amplifiers.
- Short duration "burst" tests (less than 10 seconds) part of basic system capability.
- Test records can be obtained on-line, or data can be stored and processed after test. Typical records are:
  1. Reference Standard Spectra
  2. Tolerance and Abort Limits
  3. Drive Spectra
  4. Stored Power Spectral Density both Logarithmic and Linear
  5. Post test Transmissibility from stored data in either power or voltage ratios.
  6. PSD vs. Reference Standard
  7. PSD vs. PSD.
  8. PSD vs. DRIVE SPECTRUM
- Totally independent operation of any station including accelerometer normalization, PSD profile, sequence and levels, time of test, rms protection, data logging or test confirmation plots.

1.6 OPTIONS AVAILABLE

1.6.1 Multi-channel Systems

In certain systems, multiple accelerometer inputs will be required, usually for Multi-point Averaging (MPA). Such systems will incorporate a Model SD401 Channel Selector which selects any one of 16 accelerometer inputs for Spectral analysis.

1.6.2 Multi-shaker Systems

SD1200 Systems are available for controlling as many as 32 individual shakers. Multi-shaker systems contain a Model SD401 Channel Selector. Each shaker also requires an additional Model 13379 DDR/DAC and a Model SD400 System Control with an RMS Detector.

1.6.3 RMS Detector

The RMS Detector is a plug-in assembly which may be installed in the Model SD400. During periods when the computer is servicing another station, the RMS Detector provides undertest and overtest protection for the shaker system being controlled by an SD400.

1.6.4 Remote System Control

Several options are available to facilitate remote operation of an SD1200 system. Total remote control of any station Via simple cable hook-up or Spectral Dynamics supplied modems is possible.

1.6.4.1 SD410 Remote Control

The Model SD410 is used as a limited remote station controller and as an interface between an environmental chamber controller and the Model SD400. In the latter capacity, the SD410 accepts parallel input information from the chamber controller and retransmits in serial form to the SD400 System Control Unit. When the Model SD410 is used, a Remote Interface option is included in the SD400 to permit serial digital data transfer between the units. This option permits communication over two twisted pairs at distances of up to 750 feet. For distances beyond 750 feet, a MODEM interface option may be added. It provides 1200-baud, full-duplex communication between the SD410 and the SD400. Consequently, the SD1200 series is an ideal solution to requirements for Controlled Environmental Random Testing (CERT) under conditions described in MIL-STD-781-C.

1.6.5 Datalogging Software

With the Datalogging option, a DEC DL11-W interface card must be used in the mainframe of the DEC computer. Data may be logged at anytime by an appropriate command from an external device or the system terminal. The following data may be transmitted for logging purposes: station number, date, time, test time expired, test time remaining, RMS level, and abort code.

1.6.6 Peripherals

Various peripherals such as video terminals, digital/analog plotters, floppy/hard disks units, and X-Y displays can be added as required.

1.7 ANCILLIARY EQUIPMENT

Customer supplied external equipment such as line printers may be connected to SD1200 series Systems.

1.8 EQUIPMENT REQUIRED (CUSTOMER SUPPLIED)

An external sensing device is required to produce the input signal to be analyzed by the SD1200 system. This device may be one of several types of dynamic motion or audio measuring devices (transducers).

Depending upon the equipment being tested, the input transducer can be either an accelerometer, microphone, velocity pickup or displacement probe.

The end-user is also required to supply the following equipment:

a. mechanical shaker
b. power amplifier and cables
c. charge amplifier and cables

1.9 SD1200 SERIES SPECIFICATIONS

FREQUENCY RANGES

1200A 100Hz, 500Hz, 1kHz, 2kHz, 3kHz, 4kHz, and 5kHz (programmable) with 500 lines of resolution

1200B 100Hz, 500Hz, 1kHz, 2kHz, 3kHz, 4kHz and 5kHz (programmable) with 125 or 250 line of resolution

DYNAMIC RANGE

Reference Spectrum 36 dB; Equalization 72 dB

SYSTEM SENSITIVITY

Selected under Dialog Control in MV/g, 10 volts Peak input max.

OUTPUT LEVEL

20 V pp (Typical) 24 V pp MAX.

CONTROL SIGNAL

Selectable Pseudo-Random or Random with Stationary Gaussian Distribution. Program can select Pseudo-Random through any pretest levels and then change to Random at higher levels.

CONTROL TOLERANCE

± 1.0 dB to 20 dB nominal with 154 DEGREES OF FREEDOM,125 filters. Standard Program. Tolerance can be changed by changing number of Degrees of Freedom (DOF).

CONTROL RESOLUTION

Variable, depending on desired confidence level of control.

Number of Filters	Filter Spacing	Averages	Confidence Degrees of Freedom	Nominal Equalized Time
125 Standard	16Hz	64	154	5.1 sec.
250 Optional	8Hz	128	154	9.6 sec.
500 Optional*	4Hz	256	154	14.0 sec.

* Available on SD1200A only

NOTES Above number of DOF's are standard in program and can be changed-through TTY-to any number of DOF's with corresponding change in confidence level and equalized time.

PACKAGE AND SYSTEM PROTECTION TO PREVENT OVERTEST

1. Accelerometer not connected at turn on.
2. Accelerometer/Charge Amp. failure/Disconnect during test.
3. Charge Amp. Slow change in normalization on long-term test. Manual set, Automatic Control-Limits output level.
4. RMS level overlimit. Automatic.
5. Single line (Filter) overlevel. Automatic.
6. Shaker overtravel. (External connection)
7. External RMS protector. (External connection)
8. As required. (External connection)
9. As required. (External connection)
10. Manual stop.

STARTUP AND SHUTDOWN TIME

Typically set at 30 MS/dB to 60 dB, 1.8 sec. Max (Program controllable for other rates).

ABORT AND STATUS CONTROL/INDICATION (LED Readout in 2-Digit Code)

STOP CODE	MEANING	STOP CODE	MEANING
1	LOCAL MANUAL STOP	16	RTA OUT OF CAL.
2	LOC. EXTERNAL ABORT 1	17	RTA ON WRONG RANGE
3	LOC. EXTERNAL ABORT 2	18	RTA INTERRUPT ERROR
4	LOC. EXTERNAL ABORT 3	19	SD400 POWER FAIL
5	REMOTE MANUAL STOP	20	SD400 ECHO ERROR
6	REM. EXTERNAL ABORT 1	21	SD400 ILLEGAL INTERRUPT
7	REM. EXTERNAL ABORT 2	22	SD400 CLOCK ERROR
8	TEST TIME COMPLETE	23	OUTPUT ATTEN. ERROR
9	CHAMBER STOP	24	INPUT ATTEN. ERROR
10	CHAMBER ALARM	25	SD401 POWER FAIL
11	LOSS OF SIGNAL	26	SD401 SWITCHING ERROR
12	RMS UNDERTEST	27	ILLEGAL INTERRUPT
13	RMS OVERTEST	28	SD401 COMMUNICATION ERROR
14	LINE UNDERTEST	29	SD401 ILLEGAL INTERRUPT
15	LINE OVERTEST	30	DEVICE NOT PRESENT
		31	PROGRAM FAILURE

SAFETY AND STATUS FUNCTIONS/INDICATOR LIGHTS

CAL	FULL TEST	LOOP OPEN (ACCEL. SIGNAL)
START	ABORT	BYPASS (SYSTEM CLOSED ON SELF)
PRETEST	TOLERANCE	POST-TEST DATA
4 PRETEST LED'S	GAIN (LOW)	

TEST-PROGRESS CONTROL

Manual or automatic control from start to full test level. Automatic mode can be converted to manual by pushbutton control.

PRETEST LEVELS

Up to four may be selected at desired number of dB below full level in program dialog. Control panel LED's indicate progress through each level.

TEST TIME

Set in number of seconds up to 99 HRS.,59 min., and 59 sec. (standard).

TEST TIMER

Automatically starts internal timer when full test level is attained. In the event the test is stopped or aborts, the computer stores elapsed time and time to completion for post-test data recall.

TEST VISIBILITY

Continuous, updated display of real time and averaged control spectra: 250-line (standard) with SD1200B; 500-line (standard) with SD1200A.

RMS OVERALL READOUT

LED's on control panel indicate RMS overall level at each pretest level and at full test level. Updated on each control loop or by RMS DETECTER 5 times a second when installed.

TEST-IN-PROGRESS CONTROL

Programmable for 0.5 to 30 seconds prior to going to full test level, system provides TTL level change to permit automatic start of external devices (such as Tape Recorders, etc.). Normally preset to 0.5 seconds.

ON-LINE PLOTTING

PSD plots can be made on operator command at anytime during a test run as well as other profiles listed in the Data Menu.

REFERENCE TEST SPECTRA

Up to 99 spectra may be stored in the computer and recalled by control panel digiswitch selectors. Initial and final slopes plus 50 breakpoints are standard. (Additional spectra and breakpoints available on special order).

TOLERANCE AND ABORT BREAKPOINTS

Up to 16 preset tolerance and 16 abort levels can be selected across the frequency range (for each of the 99 stored spectra).

CHANGE OF RMS LEVEL ON STORED TEST PROFILES

Any reference spectrum can be ajusted up or down in 0.5 db steps to a new level without affecting shape of spectrum or tolerance and abort control and protection limits. (Steps can be changed in program to any increment). Also, the Standard Spectrum can be modified at or between two frequencies as can Tolerance and abort lines. Remains at new level until system is recycled through SAVE mode by operator, then reverts to original standard.

POST-TEST DATA REDUCTION

(Standard X-Y Plotters can be used)

PLOTTER DRIVE

X Axis	0 to 1 Volt	Max
Y Axis	0 to 5 Volts	Max
Pen Drop	Automatic	N/O Relay

PLOTTER CALIBRATION

X Axis Full Scale, -1 Decade, -2 Decades Set Points
Y Axis 0 to a Full Scale of 100 dB Selectable in 10 dB steps

PLOT SCALING

RMS level of each stored spectrum: Automatic LED readout.
g^2/Hz of each spectrum plotted: Automatic LED readout.

DATA AVAILABLE FOR PLOTTING/DISPLAY

1. Reference Spectrum PSD, automatically stored.
2. Last response spectrum PSD prior to shutdown, automatically stored.
3. Last drive spectrum to shaker prior to shutdown, automatically stored.
4. Up to 99 On-line spectrum PSD's stored by pushbutton command.
5. Items 1 through 4 can be displayed on X-Y display, graphics terminal, or digital plotter.
6. System can be operated to accept, store and plot scaled data from taped response data made during test while stopped or running.
7. Test Time-Elapsed and Time Remaining. On command via all graphic displays.
8. Transmissibility between stored PSD and Standard Spectrum, Drive Spectrum, or another stored PSD.

ON-LINE PSD STORAGE

During test routine, the following number of PSD's can be stored for post-test recall for viewing and plotting by pushbutton control.

"Standard"	99

RECORD NO. LED indicator advises which has been stored (i.e. "2" indicates second record has been stored). In addition, the last response spectrum is automatically stored.

TTY OPERATOR FUNCTIONAL CONTROL (99)

1. Define Program.
2. List Program in storage.
3. List Portions of Program in Storage.
4. Edit Portions of Program in Storage.
5. Save program for future use on disk by command.

TTY PROGRAM CONTROL

1. Set number of DOF.
2. Set Pseudo-Random/Random in Pretest and Full Level Positions.
3. Set starting level in DB down from full test.
4. Set starting output voltage limit.
5. Set Total Test Time.

OPEN LOOP OPERATIONAL MODES

At full test level, drive signal is frozen at a controlled level, and the system will accept pushbutton command to output last equalized drive signal. Only external protection is operable in open-loop operation. Real time analysis of out-of-band energy can be viewed and/or stored for post-test recall and plot out. Other accelerometer responses can be viewed and/or stored for post-test recall and plot out.

SYSTEM OPTIONS

For options to adapt the system to special applications and test conditions, please contact the factory.

1.10 REPLACEMENT PARTS

The following tables list the SD1200 system printed wiring assemblies which must be ordered from Spectral Dynamics. In general, standard electronic parts have been used throughout the instruments. When ordering replacement assemblies, be sure to include the reference designator, a complete description, and the part number. Also include the instrument serial number and the complete model number-including "dash" number. Table 1-1 lists the part numbers for those Spectral Dynamics wiring assemblies that are housed in the PDP11 computer.

Refer to the appropriate manual for the SD330A, SD301D, SD309 and SD311 printed wiring assembly part numbers.

Table 1-1 SD Assemblies Housed in PDP11 Computer

Ref. Desig.	Description	Part NO.
----	13380 Input/Out Card	21179900
----	13380-2 Input/Output Card	21179901
----	13379-1 DDR/DAC	21179800

Table 1-2 SD400 Printed Wiring Assemblies

Ref. Desig.	Description	Part NO.
A2A1	Control Card	21169000
A2A2	Mini Level Switch Card	21169500
A3A6,A3A	Attenuator	21162500
A3A8	Clock Timer Generator	21163300
A3A9	Priority Encoder	21170300
A3A10	Command Decoder	21154000
A3A11,A3A12	I/O Card	21176000
A3A13	Interface Card	21162900
A4A1	BNC Card	21171700
PSI	Power Supply	21168900

Table 1-3 SD401 Printed Wiring Assemblies

Ref. Desig.	Description	Part NO.
A2A1	PWA Display	21175000
A3	PWA Control	21175300
PS1	Power Supply Assembly	10722100
PS2	Power Supply Assembly	10722102

Table 1-4 SD410 Printed Wiring Assemblies

Ref. Desig.	Description	Part NO.
A2	Display Card	21178500
A3	Remote I/F Card	21178800
A4	Control Card	21181500
PS1	Power Supply Assembly	10722100
PS2	Power Supply Assembly	10722102

SECTION II
INSTALLATION

2.1 INTRODUCTION

This section contains warranty information, the procedures for initial inspection, installation, preparation for use, handling/shipping damage or in-warranty repairs, and repacking the system for shipment.

2.2 INITIAL INSPECTION

2.2.1 Unpacking

Carefully remove the instrument from the shipping container to avoid damage to the front-panel displays or rear-panel connectors. Accessory kits may be packaged separately. Check the items received against the packing slip. Save the shipping container and packing material until the system has been inspected and operationally checked as outlined in Section III of this manual.

2.2.2 Inspection for Physical Damage

Inspect all panels for dents, chipped paint or scratches. Check for bent/broken switches or connectors. Photos of damage are recommended to substantiate subsequent claims.

2.2.3 Packing For Reshipment

If the system units are to be reshipped after receipt, use the original shipping containers and packing material. If they are not available, the following materials are recommended.

a. A double-wall carton, test strength 350 pounds. The carton Should be large enough to enclose the instrument when surrounded by the packing materials listed in b, c, and d.
b. Heavy paper cardboard covering all instrument surfaces.
c. Polyurethane, bubble pack, or corrugated paperboard between instrument projections and the carton inner wall.
d. At least 4 inches of shock-absorbing material such as extra-firm polyurethane.

2.2.4 Warranty or Damage Claims

If the SD1200 system was physically damaged in shipment or does not operate as specified, immediately notify the carrier and the nearest Spectral Dynamics Sales/Service office or representative. (Spectral Dynamics offices and representatives are listed in the rear of this manual). The local office will arrange for repair or replacement of the instrument.

NOTE

Please be sure to attach a card to the instrument showing your company's name, address and telephone number. A short description of the damage or problem will also help.

2.3 SAFETY PRECAUTIONS

The SD1200 system presents no hazards to operators if operated according to the instructions in this manual. Read the following Safety precautions before applying power to the instrument.

2.3.1 Explosion Hazards

Do not operate the SD1200 system in any area where flammable vapors may be present. Operating ANY AC-line-powered instrument in such an environment can cause an explosion.

2.3.2 Shock Hazard

The three-conductor AC line cord provided with the SD1200 system is intended to ground the front panel and frame to prevent shock and injury to personnel. In most cases the national and local electrical codes require three-conductor AC outlets which connect the third wire of the line cord to power ground.

If the AC outlets where the SD1200 system is to be operated are two wire types it will be necessary to:

a. Install a three-wire to two-wire adaptor between the instrument and the outlet.
b. Connect the adaptor ground lead to ground at the power outlet BEFORE connecting the instrument.
c. Test for ground continuity between the equipment chassis and any adjacent equipment, or metal plumbing to ensure the operator cannot become a conductor between power ground and building ground.

Instrument covers should be removed ONLY by qualified personnel. Dangerously high voltage is present inside the instrument whenever the power cord is connected. Never remove the covers when the AC line cord is connected to the AC power outlet.

2.4 PREPARATION FOR USE

2.4.1 Power Requirements

The Model SD1200 system is designed to operate from either 105 to 125 VAC or 210-250 VAC. Before connecting individual equipment to the power line:

a. Set the 115/230 switch on the rear panel of all equipment to read the appropriate voltage.
b. Install the correct line fuse as shown on the rear panel FUSE DATA plate.

2.4.2 Mounting

The SD1200 system components are normally installed in a 19-inch equipment rack. Mounting brackets are included in the accessory kit provided.

2.4.3 Cooling

The SD1200 system cabinet has two input fans at the bottom and one exhaust fan at the top. The convection cooling vents at the bottom front and the top of the cabinet should not be obstructed.

2.4.4 Equipment Interconnections

The SD1200 system requires connection between the system components and customer furnished equipment as shown in Figure 2-1.

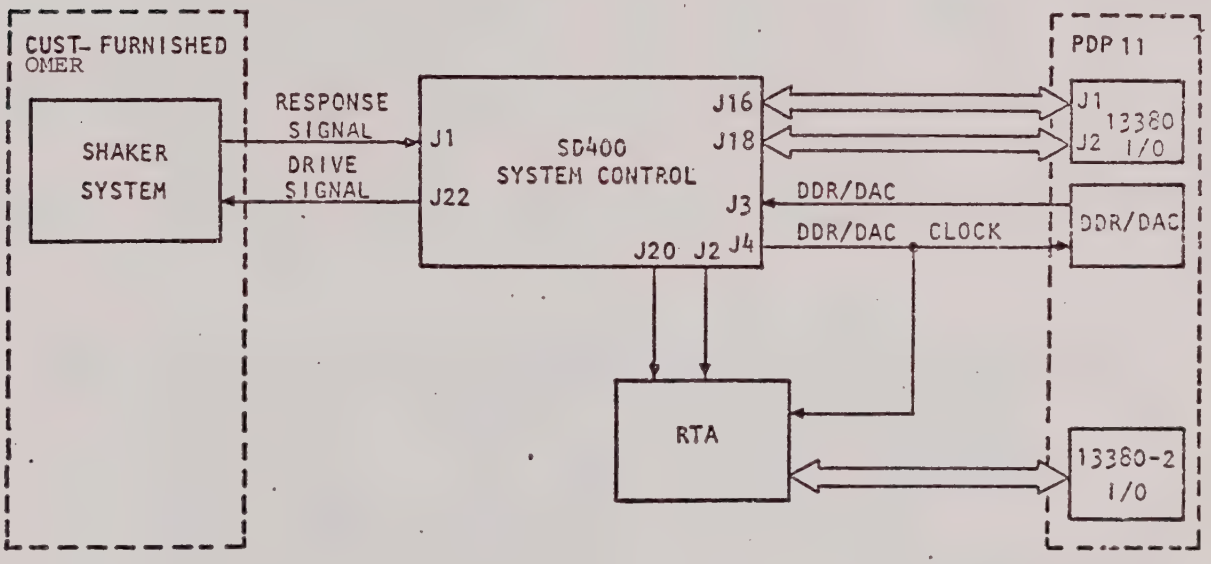


Figure 2-1. Basic SD1200 Series Interconnect Diagram

SECTION III
SYSTEM OPERATION

3.1 INTRODUCTION

This section provides the operator with a description of the front and rear panel controls and indicators. Preoperating checks, initial powering, setups, and adjustments are also included. The final sections cover software procedures and system operation.

3.2 FRONT PANEL DESCRIPTION

3.2.1 Model SD400 System Control

The SD1200 system is controlled from the front panel of the Model SD400 System Control. The System Control front panel comprises four groupings, as shown in Figure 3-1.

Group 1 (SETUP GROUP) permits the operator to define or edit test parameters via the system terminal, to check system calibration, to select whether tolerance and abort limits will appear on the system terminal display and/or output records, to select either linear or logarithmic scaling of the displays or records, to select the type of annotation that will appear, and to select the type of output record to be produced by the system.

Group 2 (CONTROL/DATA DISPLAY GROUP) permits the operator to edit control settings and test parameters when the system is operating on line.

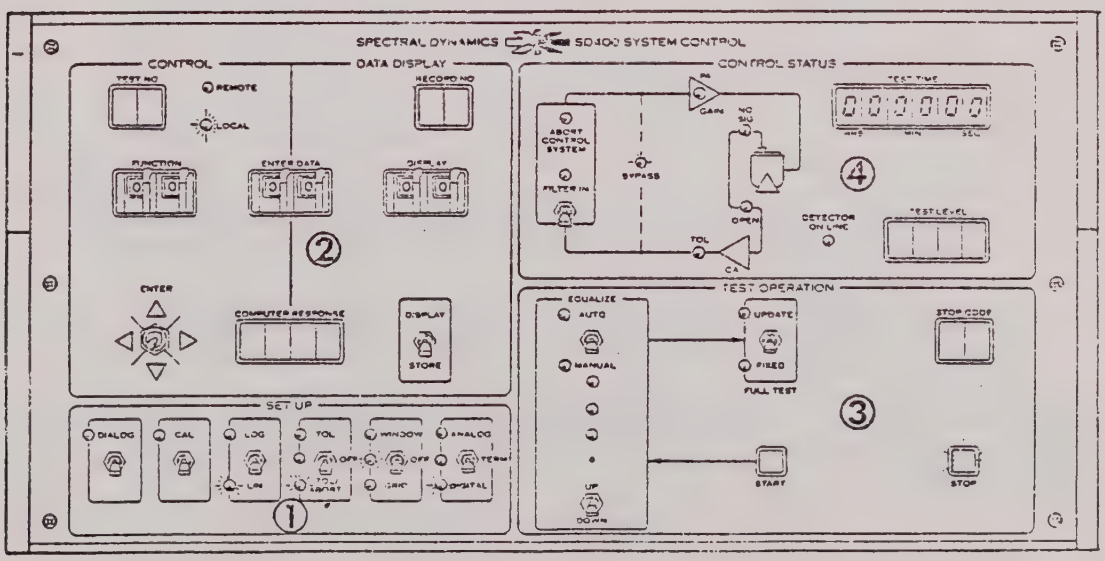
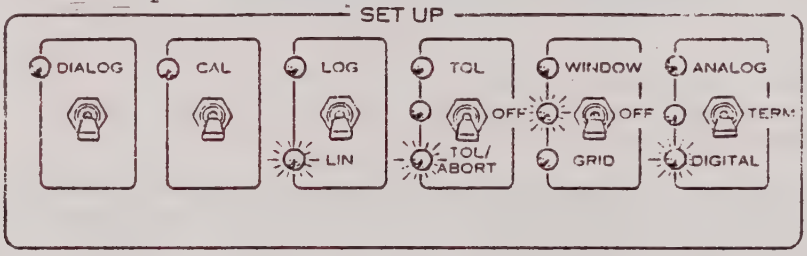


Figure 3-1. Model SD400 Front Panel Groupings

Group 3 (TEST OPERATION GROUP) permits the operator to select either manual or automatic system control and, if he selects manual control, to vary the system drive levels in the PRETEST and TEST states. It also permits the operator to select Open-Loop or Closed-Loop operation in the TEST state, to start or stop the test, and to determine the cause of any abort that occurs.

Group 4 (CONTROL STATUS GROUP) provides all pertinent control status indications during the actual test run.

3.2.1.1 SETUP Group



DIALOG Switch - a momentary toggle type switch which activates the system terminal, allowing the operator to define, list, and edit test parameters.

CAL - a momentary toggle type switch that initiates a system diagnostic routine which includes checks of frequency calibration, linearity, system control loop status, and signal paths.

LOG/LIN - a switch used to select either linear or logarithmic (X axis) scaling for the graphics display or plotter.

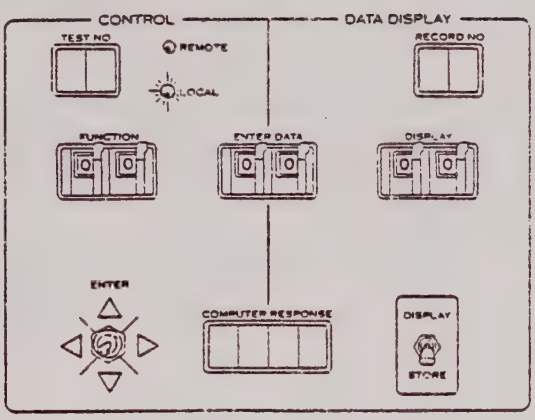
TOL-OFF-TOL/ABORT - a three-position switch used to select any one of three ways of plotting or displaying response data with tolerance bands super-imposed, without tolerance bands, or with both tolerance and abort bands superimposed.

WINDOW/OFF/GRID - a three-position switch used to select any one of three levels of graphics annotation:

a. The WINDOW position the program to erase the graphics terminal screen prior to display and frames the data display and identifies significant frequencies and amplitude levels.
b. The OFF position presents the data with no annotation and also allows the operator to superimpose responses displayed on the terminal.
c. The GRID position includes a graticule and complete annotation of frequencies and amplitude levels. It also causes the program to erase screen prior to display.

ANALOG/TERM/DIGITAL - a three-position switch that permits selection of outputs for driving an analog plotter, a graphics terminal, or a digital plotter.

3.2.1.2 CONTROL/DATA DISPLAY Group



FUNCTION - a two-decade mini-lever digital switch. It is used to select a particular test parameter for on-line editing. Switch settings and the corresponding parameters are listed in the menus shown in section 3.7.5 (On-Line Editing).

ENTER DATA - a two-decade mini-lever digital switch that performs the following functions:

a. Enter the desired test number in conjuction with the FUNCTION switch. The selected test number is displayed on the TEST NO. indicator.
b. Recall previously-stored response spectrum data.
c. Enter on-line spectrum response data.
d. Select pre-test drive-signal levels, in conjuction with the DISPLAY switch.

COMPUTER RESPONSE - an indicator that displays test parameters being displayed and modified during On-line editing.

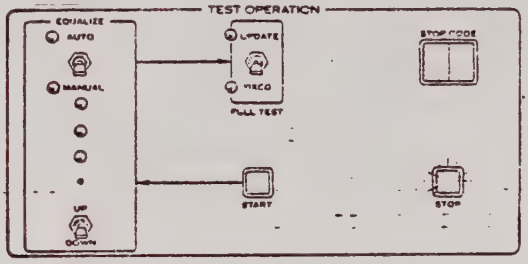
DISPLAY - a two-decade mini-lever digital switch that selects the display for the graphics terminal. The listings (menus) that may be selected are listed on a Master Menu shown in section 3.7.5.

ENTER - an eight-position joystick switch. This switch is used for On-line editing to move the cursor on the graphics terminal (or the pen on the plotter) to modify test parameters and the test profile or control tolerances. As values are changed, the new values are displayed on the COMPUTER RESPONSE indicator.

DISPLAY/STORE - a switch that when toggled to DISPLAY, issues a command to display the data that has been called up by the DISPLAY switch setting. The data is displayed on the COMPUTER RESPONSE indicator or the system terminal. Having displayed the selected data, the operator may modify it with the ENTER joystick. The modified data is stored by toggling the DISPLAY/STORE switch to STORE. This switch is also used to store graphics displays.

RECORD NO. - a display that indicates the record number of the selected, stored, or displayed response data. The record number is selected by the settings of the DISPLAY and ENTER DATA controls.

3.2.1.3 TEST OPERATION Group



The TEST OPERATION group permits the operator to perform the random vibration test either automatically or manually, including stopping or aborting the test sequence.

START - a button that the operator uses to activate the test that he has selected. The test number is displayed on the TEST NO. indicator located in the CONTROL/DATA DISPLAY Group.

AUTO/MANUAL - a switch that allows the operator to select automatic control or to assume manual control of level increases in the PRETEST state. LED's indicate whether the system is in automatic or manual control.

UP/DOWN - a toggle switch that permits the operator to override the programmed transitions through the PRETEST state. LED's indicate the current pretest level.

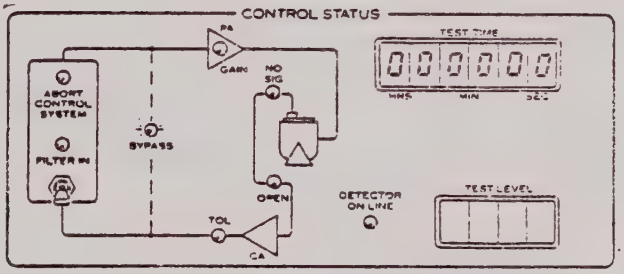
FULL TEST - a switch that permits either open-loop or closed-loop testing. The FIXED position (open-loop) inhibits drive spectrum equalization, allowing analysis of response accelerometer outputs or out-of-band energy detection with the RTA while outputting an unchanged drive signal to the shaker system. Fixed equalization saves time when testing identical specimens.
In the UPDATE position (closed-loop), the drive spectrum is repeatedly equalized, providing continuous correction and closed-loop system control.

STOP - a pushbutton/indicator that permits the operator to stop or abort the test sequence. The indicator lights when the test is interrupted. The STOP CODE indicates why the test was stopped, as shown below.

STOP CODE	
1	LOCAL MANUAL STOP
2	LOCAL EXT. ABORT NO. 1
3	LOCAL EXT. ABORT NO. 2
4	LOCAL EXT. ABORT NO. 3
5	REMOTE MANUAL STOP
6	REMOTE EXT. ABORT NO. 1
7	REMOTE EXT. ABORT NO. 2
8	TEST TIME COMPLETE
9	CHAMBER STOP
10	CHAMBER ALARM
11	LOSS OF SIGNAL
12	RMS UNDERTEST
13	RMS OVERTEST
14	LINE UNDERTEST
15	LINE OVERTEST

STOP CODE	
16	RTA OUT OF CALIBRATION
17	RTA ON INCORRECT RANGE
18	RTA INTERRUPT ERROR
19	SD400 POWER FAILURE
20	SD400 ECHO ERROR
21	SD400 ILLEGAL INTERRUPT
22	SD400 CLOCK ERROR
23	OUTPUT ATTEN. ERROR
24	INPUT ATTEN. ERROR
25	SD401 POWER FAILURE
26	SD401 SWITCHING ERROR
27	SD401 ILLEGAL INTERRUPT
28	SD410 COMMUNICATIONS ERROR
29	SD410 ILLEGAL INTERRUPT
30	DEVICE NOT PRESENT
31	PROGRAM FAILURE

3.2.1.4 CONTROL STATUS Group



The CONTROL STATUS group constantly monitors and displays the status of the system control loop.

FILTER IN - a switch that permits operation of the system with the input low-pass filter in or out of the circuit while in the Fixed Drive mode. With the filter in, if the in-band energy exceeds the defined test limits the system will abort the test. With the filter out, the system will abort if broadband energy exceeds the RMS abort limit. A LED indicates when the filter is in the circuit.

ABORT CONTROL SYSTEM LED - indicates when the shaker system and System Control power amplifier are being bypassed. The system is in the bypass mode when an abort occurs, or when the system is in a diagnostic or calibration mode.

PA GAIN LED - lights when the shaker closed-loop gain is low. This occurs when (1) the System Control cannot deliver the specified drive level, or (2) the control accelerometer response is so low that the system cannot sense it properly. Low gain may be caused by an incorrect setting of the Power Amplifier Master Gain control. Insufficient accelerometer response may be caused by a broken cable.

NO SIG LED - lights if there is no accelerometer output; an abort condition is also indicated.

TOL LED - lights if a line spectrum (RTA output) equals or exceeds the tolerance limit specified in the test definition dialog.

OPEN LED - lights when the operator sets the FULL TEST switch (TEST OPERATION group) to FIXED, selecting open-loop operation.

DETECTOR ON LINE LED - activated only in systems which include RMS Detectors. Indicates when independent RMS Detector is ON LINE.

TEST TIME - a display clock which indicates total elapsed time at full-test level. It has a range of 99 hours, 59 minutes, and 59 seconds, with one-second resolution. When an abort occurs, the accumulated elapsed time is frozen until the test is resumed or a new test is begun.

TEST LEVEL - an indicator that displays the grms level of the accelerometer response signal. If the RMS Detector (option) is installed, the displayed test level is derived from its output. Otherwise, the TEST LEVEL indicator shows the grms level calculated by the computer.

3.2.2 MODEL SD301D-C-12B REAL TIME ANALYZER
See SD301D-C Instruction Manual

3.2.3 MODEL SD309 ENSEMBLE AVERAGER
See SD309 Instruction Manual

3.2.4 MODEL SD311 X-Y DISPLAY
See SD311 Instruction Manual

3.2.5 MODEL SD330A-78A REAL TIME ANALYZER
See SD330A Instruction Manual

3.2.6 PDP 11 SERIES COMPUTER
See appropriate PDP 11 Computer User's Manual

3.3 REAR PANEL DESCRIPTION

3.3.1 SD400 System Control

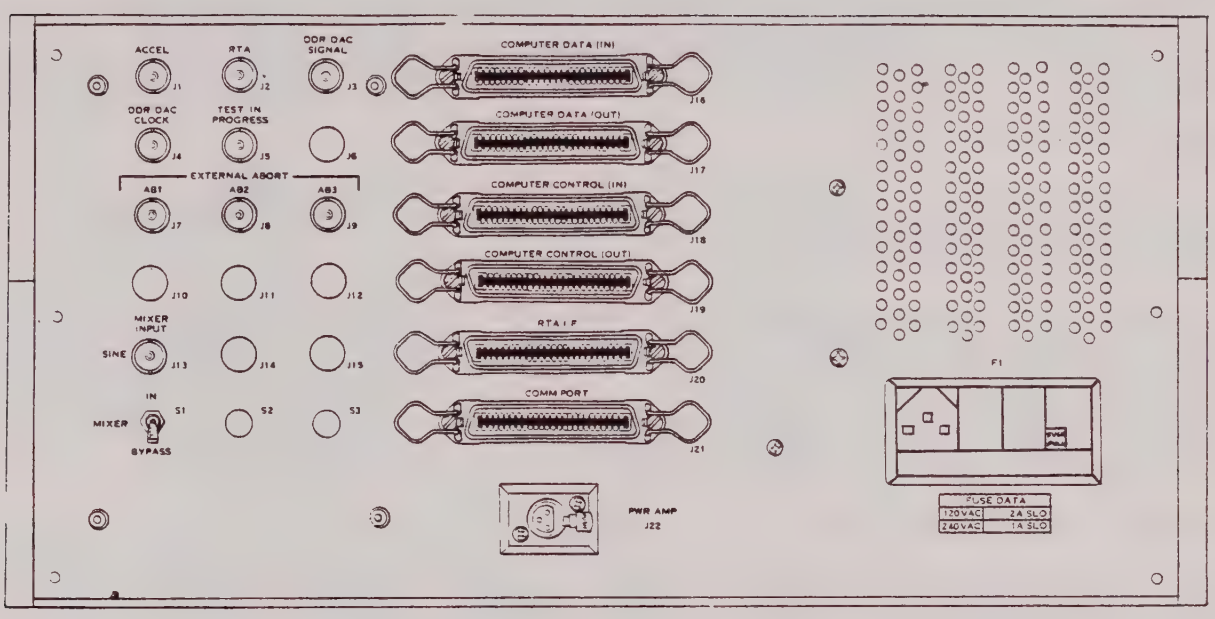


Figure 3-2 SD400 Rear Panel

ACCEL (J1)

Accepts accelerometer response input signal from shaker system or vibration data from mag tape, etc.

RTA (J2)

Provides computer amplitude controlled response signal to the Real Time analyzer.

DDR/DAC SIGNAL (J3)

Receives time-domain drive signal from the Spectral Dynamics 13379 (DDR/DAC) circuit assembly housed in the PDP 11 computer.

DDR/DAC CLOCK (J4)

Supplies the DDR/DAC and the Real Time Analyzer (RTA) with a clock signal to synchronize the system.

TEST IN PROGRESS (J5)

A TTL level (positive true) change (0.5 seconds prior to full test) to permit automatic start of external devices such as tape recorders, etc

EXTERNAL ABORT AB1 (J7), AB2 (J8), & AB3 (J9)
A relay closure (between signal and ground) input used to stop the test. The STOP CODE indicator will display the code for either AB1,AB2, or AB3.

MIXER INPUT/SINE (J13)

An analog adding circuit used to add tones for sweep sine wave (10V peak maximum) testing superimposed on random vibrations.
COMPUTER DATA IN (J16)

Accepts data from the computer output register and transfers data to the computer input register. The transfer of data between the SD400 and the computer is a "handshake" operation in which signals are sent and received by both elements whenever a data word is transferred. Front panel control settings can be sensed by the computer in either the LOCAL or REMOTE mode.

COMPUTER DATA OUT (J17)

Delivers outputs that correspond to the data at J16 (COMPUTER DATA IN). These outputs may be "daisy-chained: to other SD400's in multishaker control systems.

COMPUTER CONTROL IN (J18)

Accepts select command data from the Computer Command Status Register (CSR) as well as the required control signals. This data provides the commands which determine the interupt priorities of the various system units.

COMPUTER CONTROL OUT (J19)

Delivers outputs that correspond to the input control signals at J18. These outputs may be "daisy-chained" to other SD400's in multishaker control systems.

RTA I/F (J20)

Output signal to the RTA where it is converted from a time domain signal to a frequency domain signal.
COMM PORT (J21)
COMM PORT (J21)

Provides two way serial communications to the SD410 Remote Control unit via transmit and receive twisted pairs.

PWR AMP (J22)

A drive signal to the power amplifier which drives the shaker.

MIXER IN/BYPASS (S1)

A two-position toggle switch which enables (IN position) or disable (BYPASS position) the MIXER INPUT/SINE signal at J13.

F1 (Fuse and Power)

The power-line fuse (F1) is a 3AG Slo-Blo fuse. The rating of F1 is 2 amps for 115 Vac and 1 amp for 230 Vac operation.

The power receptacle accepts a 3-pin AC line cord for applying 115/230 Vac, 47-65 Hz primary input power. The center terminal is chassis ground.

3.3.2 MODEL SD301D-C-12B REAL TIME ANALYZER
See SD301D-C Instruction Manual

3.3.3 MODEL SD309 ENSEMBLE AVERAGER
See SD309 Instruction Manual

3.3.4 MODEL SD311 X-Y DISPLAY
See SD311 Instruction Manual

3.3.5 MODEL SD330A-78A REAL TIME ANALYZER
See SD330A Instruction Manual

3.3.6 PDP 11 SERIES COMPUTER
See appropriate PDP 11 Computer User's Manual

3.4 PREOPERATING CHECKS

Certain preoperational checks and procedures must be performed before an SD1200 system is ready for use in vibration testing. Also, the operator should familiarize himself with the operating instructions pertaining to each individual system unit.

Perform the following steps before applying power to the system.

a. Check all power cord connections from individual system units to the power distribution system of the cabinet.
b. Verify that rear-panel power-select switches are set for the correct line voltage (115/230 Vac) and that the values of the line fuses are correct.
c. Verify that system interconnect cable connections coincide with the System Interconnect Diagram located in the System Hardware Manual.

3.5 INITIAL POWERING

Power may be applied to the system and it automatically enters the STOP state (STOP indicator on the System Control Unit lights).

3.6 INITIAL SETUPS AND ADJUSTMENTS

When an SD1200 System is operated, all adjustments are made from the SD400 System Control front panel. Consequently, controls for the RTA and associated equipment must be set to a standard configuration.

3.6.1 Model SD1200A Initial Setup

The SD1200A system incorporates a Model SD301D-C-12B RTA, SD311 X-Y Display and a SD309 Ensemble Averager. Controls for the above equipment are set to a standard configuration as shown in Figures 3-3 through 3-5.

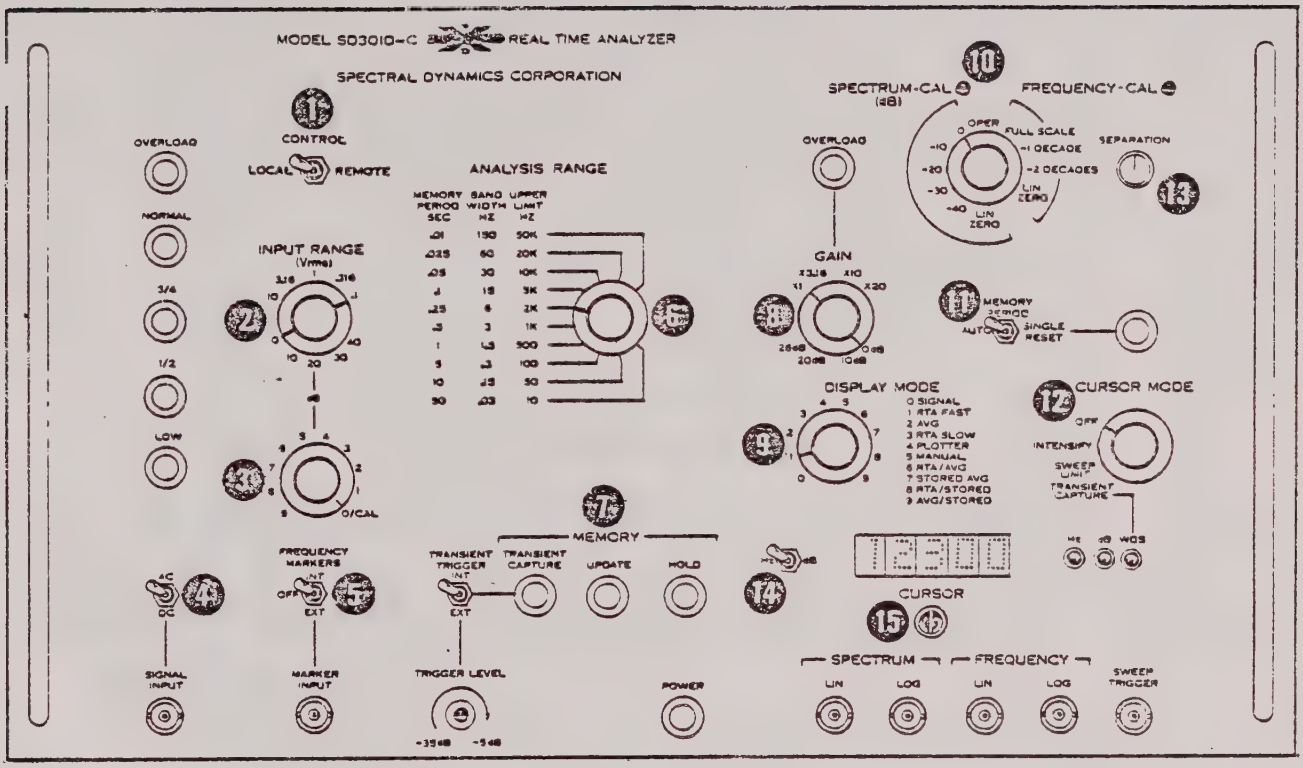
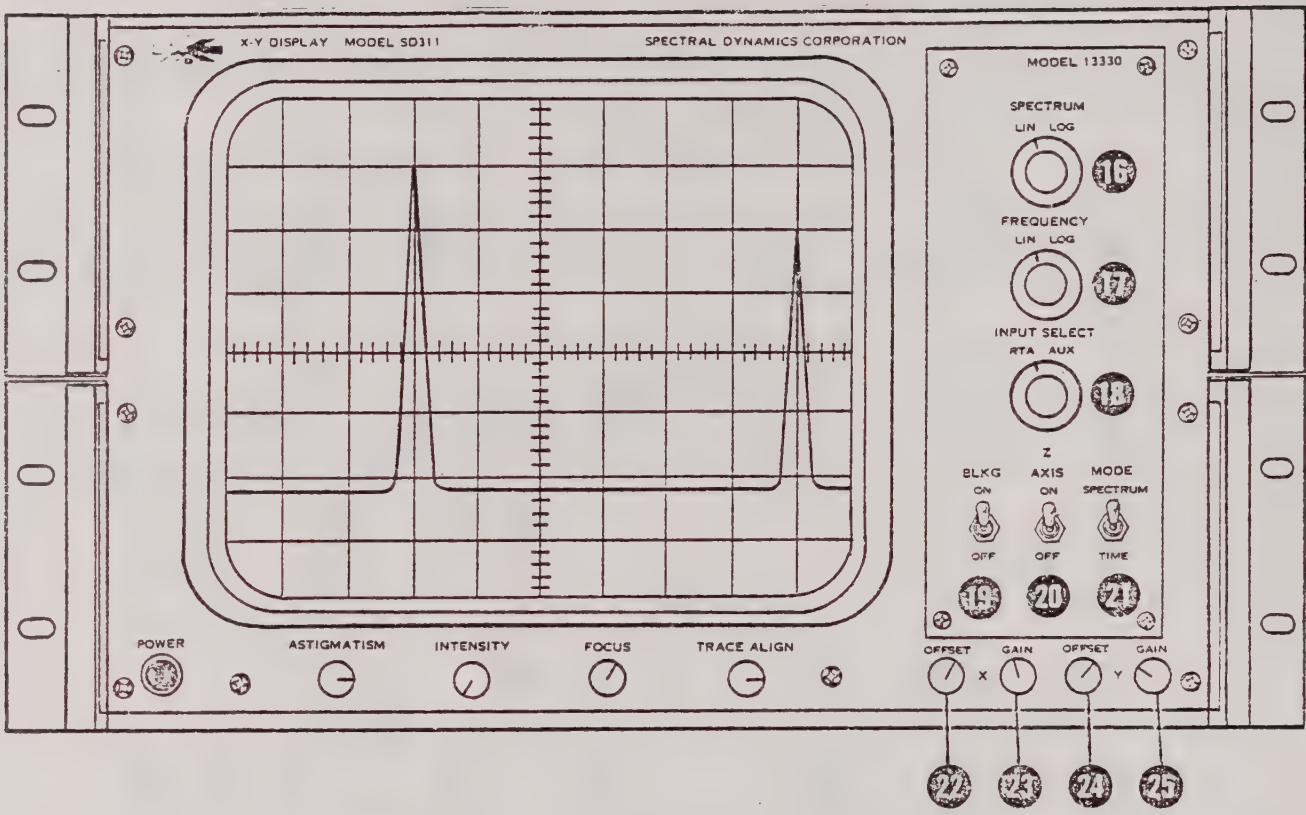


Figure 3-3 Model SD301D-C-12B Initial Control Settings

1	CONTROL	set to LOCAL
2	INPUT RANGE (Vrms)	set to .1
3	INPUT RANGE (dB)	set to 0/CAL
4	SIGNAL INPUT AC/DC	set to AC
5	FREQUENCY MARKERS	set to OFF
6	ANALYSIS RANGE	set to 2K
7	MOMORY PUSH BUTTON	press UPDATE
8	GAIN	set to X1
9	DISPLAY MODE	set to 1 (RTA FAST)
10	OPER/CAL	set to 0
11	MEMORY PERIOD	set to AUTO
12	CURSOR MODE	set to OFF

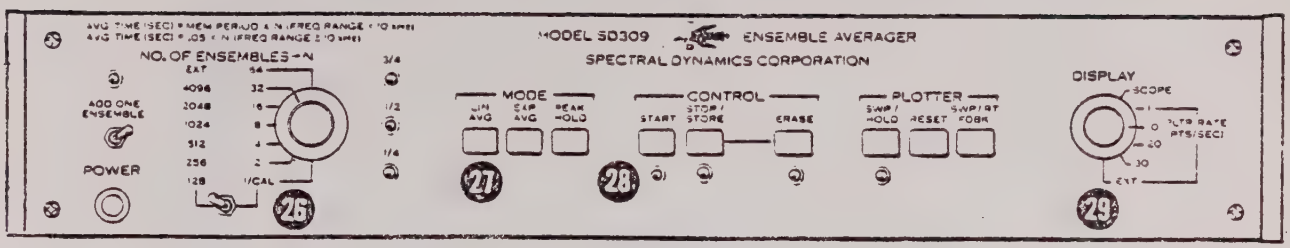
NOTES

1. There are no initial settings for controls 13, 14, and 15.
2. When performing RTA setups the CLOCK switch on the rear subpanel of the system must be switched from EXTERNAL to INTERNAL.



16	SPECTRUM	set to LOG
17	FREQUENCY	set to LIN
18	INPUT SELECT	set to RTA
19	BLKG	set to ON
20	Z AXIS	set to ON
21	MODE	set to SPECTRUM
22	X-AXIS OFFSET	set first display pulse on third vertical graticule division.
23	X-AXIS GAIN	set second display pulse on next-to-last vertical graticule division.
24	Y-AXIS OFFSET	set to postion first display pulse tip to third horizontal graticule division above centerline.
25	Y-AXIS GAIN	set to approximate amplitude shown above.

Figure 3-4. Model SD311 X-Y DISPLAY Initial Control Settings



26	NO. OF ENSEMBLES-N	set toggle switch to 1/CAL; set rotary switch to 32.
27	MODE	depress EXP AVG button.
28	CONTROL	push START button.
29	DISPLAY	set to EXT.

Figure 3-5. Model SD309 Initial Control Settings

3.6.1.1 SD1200A SYSTEM SETUP

The following sequences are keyed to the control numbering in Figure 3-3 through 3-5.

a. (10) (Figure 3-3) set to -30.

b. (24) (Figure 3-4) set the tip of the first display pulse to the horizontal centerline of the graticule as shown in Figure 3-6.

c. (10) (Figure 3-3) set to 0.

d. (25) (Figure 3-4) increase Y-GAIN to return the first pulse tip to the third division above the display centerline, as shown on Figure 3-7.

e. Repeat steps a through d until the first pulse tip touches the third division above the display centerline (Figure 3-7) when at the 0 setting (step d) and the first pulse tip touches the horizontal centerline (Figure 3-6) when at the -30 setting (step b).

f. (9) (Figure 3-3) set to position 6 (RTA/AVG).

g. (26) (Figure 3-5) set toggle switch to 1/CAL; set rotary switch to 32.

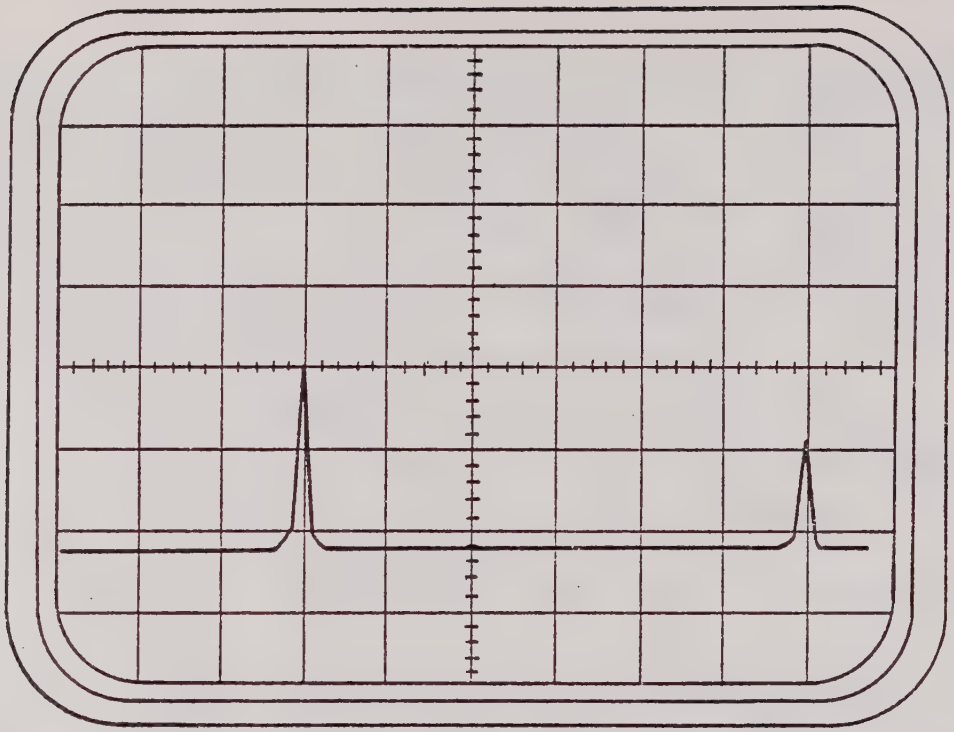


Figure 3-6. Display Adjustment (Step b).

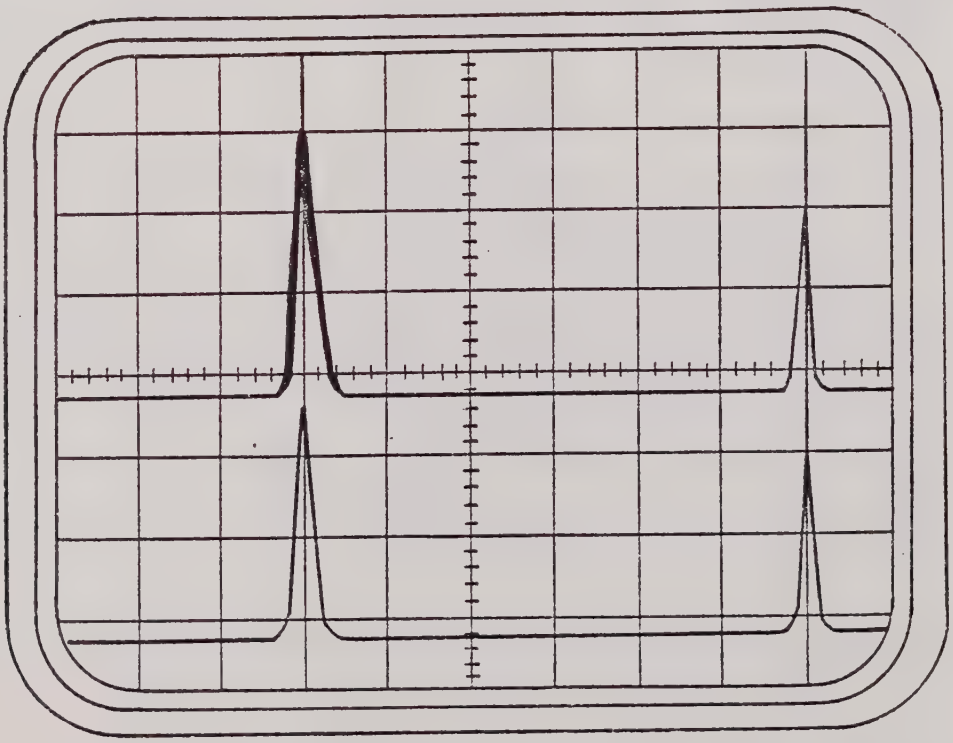


Figure 3-7. Display of Separation Adjustment (step j).

h. (28) depress EXP AVG.

i. (27) depress START button.

j. (13) (Figure 3-3) adjust SEPARATION to resemble Figure 3-7.

k. (9) set to 1 (RTA FAST)

l. (10) set to LIN ZERO (SPECTRUM CAL)

m. (5) set to INT

The display of the Internal Frequency markers should resemble Figure 3-8

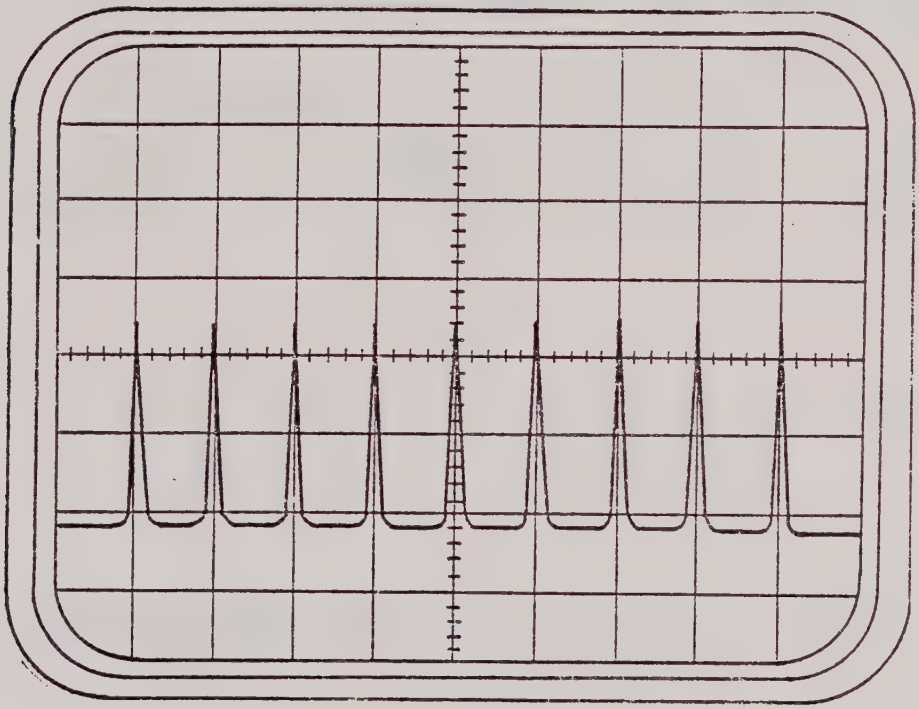


Figure 3-8 Display of Internal Frequency Markers (Step k)

n. (12) set to INTENSIFY.

o. (14) set Hz/dB switch to Hz.

p. (15) set cursor to display 0200 in RTA digital readout.

q. (14) set Hz/dB switch to dB and note reading,* then set Hz/dB switch to Hz.

r. (15) set CURSOR to display 1800 in RTA digital display.

s. (14) set Hz/dB switch to dB and note reading.*

t. (5) (Figure 3-3) set frequency markers switch to OFF.

u. (8) set GAIN switch to x 3.16.

v. (9) set DISPLAY MODE switch to position 6.

w. (10) set OPER/CAL switch to OPER.

x. (12) set CURSOR MODE switch to OFF.

y. (29) (Figure 3-5) set display to EXT.

The X-Y Display, RTA, and Ensemble Averager are now set up for system operation.

* dB levels should be equal

3.6.2 Model SD1200B Initial Setup

The SD1200B System incorporates a Model SD330A-78A Real-Time Analyzer. Figure 3-9 shows the front-panel indicators and controls applicable to the initial setup.

3.6.2.1 SD330-78A RTA Initial Setup

The initial setup procedure, along with the proper control settings, is outlined in steps a through z.

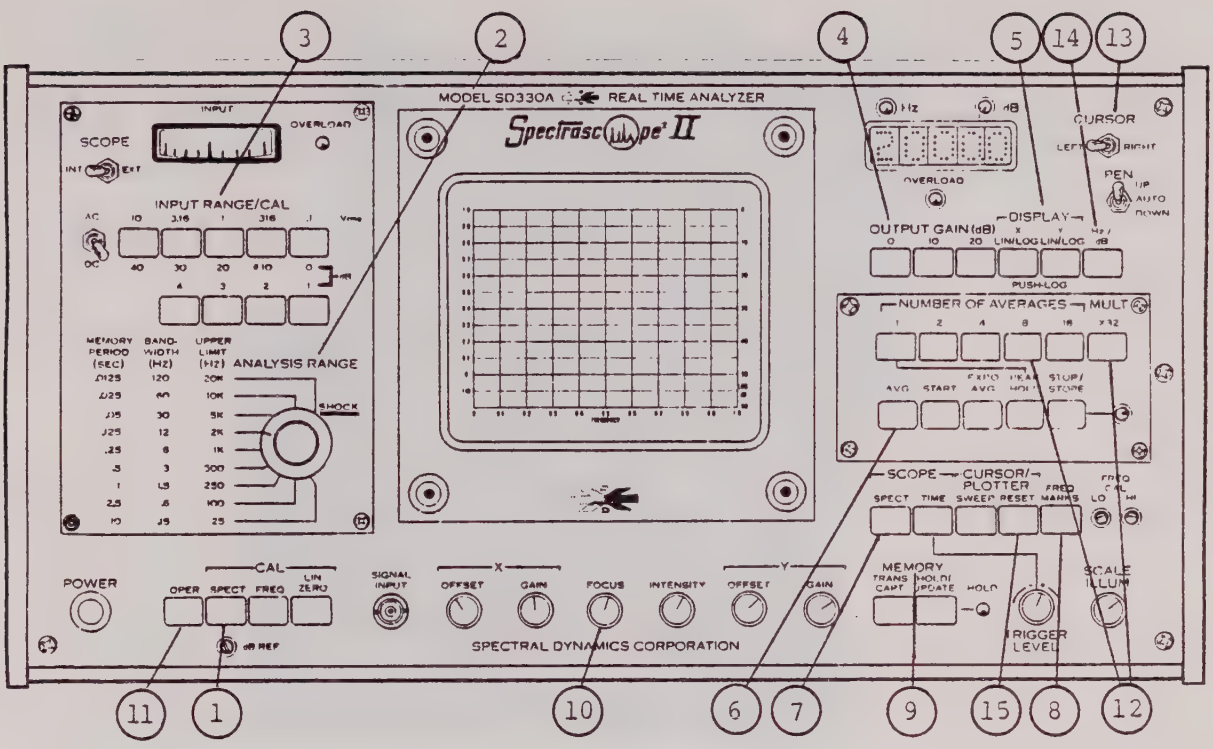


Figure 3-9. Model SD330A-78A Front Panel

NOTE

Certain pushbuttons release when partially depressed and engage when fully depressed. In the following procedure, the desired switch state will be indicated as Press (release) or as Press (engage).

a. (1) CAL - Press (engage) SPECT to select the internally generated signal.

b. (2) ANALYSIS RANGE - Set to 2K.

c. (3) INPUT RANGE/CAL - Press (engage) .1 Vrms.

d. (4) OUTPUT GAIN (dB) - Press (engage) 0 dB, setting output gain to unity.

e. (5) DISPLAY - Press (release) X LIN/LOG for linear frequency display. Press (engage) Y LIN/LOG for logarithmic ampli-

f. (6) AVERAGER CONTROLS - Press (release) AVG to bypass the averager section of the RTA.

g. (7) SCOPE - Press (engage) SPECT to display the frequency spectrum rather than the time-domain signal.

h. (8) FREQ MARKS - Press (release) to remove the 10 frequency markers from the display.

i. (9) MEMORY - Press (release) HOLD/UPDATE, selecting UPDATE mode. HOLD light turns off and reference signal is being analyzed just as an external signal would be analyzed.

j. (10) SCOPE DISPLAY - Adjust controls to produce the display shown in Figure 3-10.

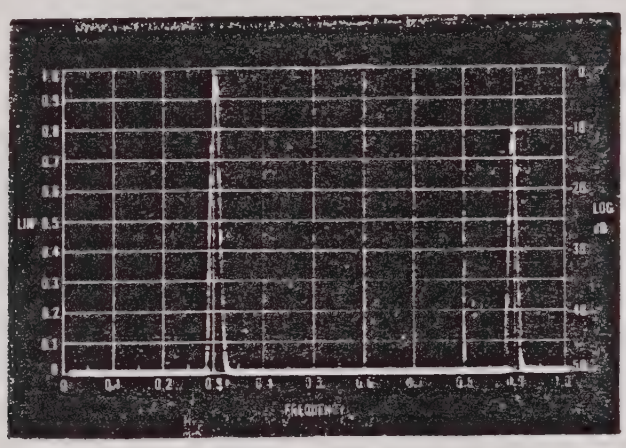


Figure 3-10 Calibration Signal

k. (9) MEMORY - Press (engage) HOLD/UPDATE to store reference signal in circulating memory.

l. (11) OPER - Press (engage) to remove the reference signal input. Memory contents and display remain, and 10 intensified dots appear.

m. (6) AVERAGER CONTROLS - Press (engage) AVG. Press (engage) STOP/STORE to average and store spectrum average.

n. (12) NUMBER OF AVERAGES - Press (engage) 8. Press (release) X32. Sets averaging time (or time constant). Disabled in averager PEAK/HOLD.

0. (6) AVERAGER CONTROLS - Press (engage) START to initiate linear averaging. The STOP/STORE indicator lights when averaging is completed. The last display (Figure 3-10) is retained and stored in Averager Memory.

p. (6) AVERAGER CONTROLS - Press (release) AVG. The display remains because of storage.

q. (9) MEMORY - Press (release) HOLD/UPDATE. The display disappears.

r. (8) FREQ MARKS - Press (engage). Ten vertical markers and 10 intensified dots appear on the display as shown in Figure 3-11.

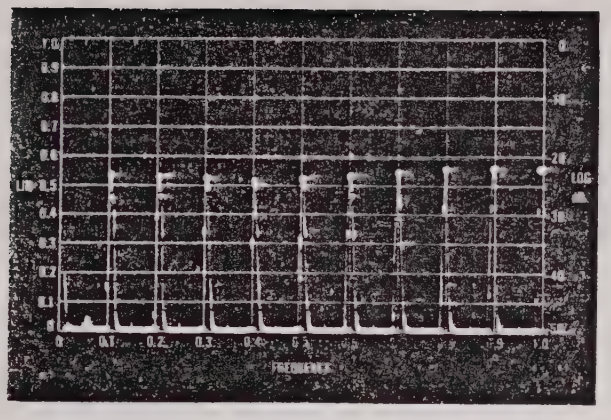


Figure 3-11 Intensified Dots Set at Top of Each of 10 Frequency Markers

s. (13) CURSOR - Press and release as required to superimpose the first intensified dot on the first marker peak.

t. (14) Hz/dB - Press (release). Hz indicator lights and LED indicator displays 200.

u. (15) CURSOR/PLOTTER - Press (engage) RESET.

v. (7) SCOPE - Press (engage) SPECT. The 10 dots reappear on the display.

w. (8) FREQ MARKS - Press (release).

y. (6) AVERAGER CONTROLS - Press (release) all pushbuttons.

z. (13) CURSOR - Press and release as required to move the intensified dot to 2000 Hz.

The SD330A-78A RTA is now ready for system operation.

3.7 SYSTEM OPERATION

When the system is received, the computer memory contains neither test programs nor system diagnostics. These programs are loaded via the system terminal.

3.7.1 Loading RT-11 Program

The PDP 11 Computer has no programmer's console. Instead, it has a Bootstrap/Terminator module with a stored Console Emulator routine. The computer startup sequence consists of the following steps:

a. Insert the System Disk (program) into Drive Ø.
b. Insert the Data Disk into Drive 1.
c. Set the DC switch on the PDP 11 Operator's Console to ON. The front panel DC indicator will light.
d. Set the HALT/CONT switch on the Operator's Console to CONT.

e. Toggle the BOOT/INIT switch on the Operator's Console to INIT and release it. It will return to the BOOT position and the RUN indicator will light. This step initializes the processor, clears the peripheral registers and starts the Console Emulator routine.

When the Console Emulator routine starts, the system terminal prints four sets of random octal numbers (6 digits each), followed by a dollar sign, as shown below.

```
Ø774ØØ    Ø1245Ø    ØØØ546    ØØ4Ø54
$
```

The system is now ready for booting to load the program.

CAUTION

Toggling the BOOT/INIT switch while running a program will abort that program and may damage the shaker or test item and the contents of the general-purpose registers and memory. The power amplifier gain should be slowly reduced to zero before activating the BOOT/INIT switch.

3.7.2 Loading the Operational Random Program

a. Boot the system to Drive Ø (the System Disk) by typing:
DYØ(CR)*
The system will print the name of the operating system followed by a dot, as follows:

```
RT-11SJ        V03B-ØØ
.
```

The dot indicates that the system is in the RT-11 MONITOR operating system. Once the system has been booted to this point, the operator may return to the RT-11 MONITOR at any time by striking the CTRL and C keys on the terminal simultaneously.

CAUTION

The terminal keyboard is enabled at all times. Typing CTRL/C during a test will smoothly stop all currently running tests and abort the program. Test Data may be lost.

* (CR) indicates that the terminal Carriage Return (CR) key should be pressed. On some terminals the ENTER key is used.

b. Type the date in the following format:
   DATE 24-OCT-79(CR)
c. Type the time in the following format:
   TIME 13:05(CR)
d. Designate the disk in Drive 1 as the Data Disk by typing:
   ASSIGN DY1DEV(CR)
e. Start the Random program by typing:
   R RANDOM(CR)

   The Random program will start, and the system STOP indicator in the TEST OPERATION group will light, indicating that the program is loaded, and that the system is in the STOP state, ready for operation.

3.7.3 Entering Test Parameters

Prior to entering test parameters, the operator must select a test number. To select a test number, toggle the ENTER switch after setting the FUNCTION switch to 00 and the ENTER DATA switch to the desired test number as indicated in the TEST SETUP MENU shown in subsection 3.7.5.3.

The operator enters the test parameters via the system terminal, which is enabled by toggling the DIALOG switch on the SD400 front panel while in the STOP state. The system will print (or display) the following menu:

TEST DEFINITION MENU

ACTION	KEYWORD
ABORT TTY STATE	Z(CNTRL Z)
DISPLAY MENU	DISPLAY
DEFINE NEW TEST	DEFINE
LIST CURRENT TEST	LIST
EDIT CURRENT TEST	EDIT
SAVE CURRENT TEST	SAVE
CHANGE TEST TIME	CHANGE

NOTE: IF NEW TEST IS NOT DEFINED THEN
CURRENT TEST IS AS PREVIOUSLY DEFINED
KEYWORD =

The desired action is selected by typing the first two letters of the keyword and striking carriage return (CR) to initiate a dialog.

DE (CR) - initiates the test definition dialog shown in Table 3-1. Questions are asked by the Computer software and the answers are defined by the operator. The standard spectrum defined by the test dialog is shown in Figure 3-12.

NOTE

Upon completion of the Define mode, the system reprints the menu. The defined test parameters, however, are only in temporary storage. A Save action, SA(CR), is required to transfer them to the test file on the disk.

Each question in the test dialog Table 3-1 is discussed in the following paragraphs. The questions are asked by the computer software and the answers are supplied by the operator.

QUESTION 1 - STARTING OUTPUT LIMIT (DB 1 VOLT)? Restricts the output voltage level of the power amplifier to a safe level in the event of no feedback from the response pickup. During the startup phase the system looks for one of two possible conditions to exist:

a. The system output will increase until the STARTING LEVEL is attained (QUESTION 7), indicating sufficient signal with which to operate; or,
b. the system will simply increase the output level to the limit that is specified in this first question of the dialog.

This limit should be set high enough to allow sufficient drive for the shaker to satisfy the STARTING LEVEL (QUESTION 7).

QUESTION 2 - TIMED TEST? (Y/N)? If the answer is yes, the computer will request the time in hours, minutes, and seconds respectively.

QUESTION 3 - RTA ANALYSIS RANGE (Hz)? Selects the RTA frequency range, number of lines (resolution) and the Degrees of Freedom (DOF).

QUESTION 4 - CONTROL ACCEL. SENSITIVITY (MV/G)? The operator enters the sensitivity in MV/G for the control accelerometer.

QUESTION 5 - AUTO? (Y/N)? In the Automatic mode, once the start button is depressed, the system will automatically progress through the specified pretest levels (Question 7). It will equalize at each level, failing to equalize at each level, it will make a preselected number of equalization attempts at each level, then automatically progress to the next level. This process is continued until the full test level is reached. The test is then run until the timer has been satisfied, or the operator terminates the test.

QUESTION 6 - FIXED DRIVE OPTION? (Y/N)? Asks whether or not to enable the "open loop" function. If the answer is YES, the feedback loop can be opened at full test level and the system will continue to output the last equalized drive spectrum into the package. This is particularly useful for doing fixture evaluations and measuring responses at other points on a package. The only danger in this is that all the software limit checking and protection is disabled. Thus, the system has no software protection and hardware protection (RMS Detector) is disabled if RMS DETECTOR option is installed.

QUESTION 7 - PRE-TEST LEVELS (PTLS) in (-DB)
NO. OF PTLS? The operator enters the number of PTLS desired. Up to four different pretest levels, can be defined at any level relative to full test level.

PTL TO GO RANDOM? The system begins at the starting level in the pseudo-random mode and will shift to the RANDOM mode at the pretest level (1-4) entered by the operator. If zero is entered, then test is run in Random Mode thru-out test. If five is entered, then test will be run random at full test. If six is entered, then test will be Pseudo Random thru-out.

STARTING LEVEL ? Specified in (-DB) from full test. The level at which first equalization is attempted. This checks that all system components are properly connected to form a complete circuit. The STARTING OUTPUT LIMIT (QUESTION 1) should be set high enough to allow for the desired STARTING LEVEL.

QUESTION 8 - RMS ABORT

OVER TEST?
Asks for an RMS Abort in dB, if the test is exceeded by XdB, the system will shut the test down.
UNDER TEST?
Same as over test, but here this protection is only in effect while at full test. Loss of signal is always in effect however. The loss of signal threshold is set 10dB down from the STARTING LEVEL.

QUESTION 9 - SPECTRUM

STARTING FREQUENCY? - operator enters lowest frequency in Hertz.

ENDING FREQUENCY? - operator enters highest frequency in Hertz.
EXTERNAL REFERENCE? (Y/N)? The accelerometer signal or vibration input data can be applied as the reference signal to the SD400 (J1). If YES is answered, then the system will set a flag so that the test cannot be run until an external reference is entered via the TEST SETUP MENU (3.7.5.3) while in the stop state.

INIT SLOPE?
Asks for the inital slope in dB/OCTAVE.
FINAL SLOPE?
Asks for the final slope in dB/OCTAVE.
NO. BRKPNTS?
Asks for the number of frequency breakpoints desired. Up to 50 can be defined.
FOR BRKPNT NO. 1
FREQ? - operator defines frequency in Hz.
AMPL? - operator defines amplitude in g

QUESTION 10 - TOL AND ABORT SECTORS.

NO. SECTORS?
If the number entered by the operator is greater than one, the system will ask for the "ending" frequency of the first sector. The starting frequency of the first sector is given in QUESTION 9.
Up to 16 tolerance and abort sectors can be defined. The following dialog for each sector is prompted by the computer.
FOR SECTOR NO. 1
+ TOL ?
- TOL ?
+ ABORT ?
- ABORT ?
The system then asks for the ending frequency of the second sector and the dialog is repeated. The starting frequency of the second sector is the ending frequency of the first sector.

QUESTION 11 - TEST IDENTIFICATION

TEST I.D. ? CONTRACT NO.
GRAPH LABEL ? P/N
Answers to the above questions are used to identify the test and are printed at the top and bottom of a graph plot.

QUESTION 12 - GRAPHICS SETUP

AMPLITUDE SPAN (DB)? - Defines the amplitude range (maximum - minimum).
DISPLAY FREQUENCY RANGE
FROM (Hz)? - self explanatory
TO (Hz)? - self explanatory
FULL SCALE PSD VALUE? The operator defines the maximum Power Spectral Density (PSD) value in G /HZ that can be displayed in the highest decade. If zero is entered then the control reference PSD maximum plus the alarm tolerance G /HZ will be used for scaling purposes.
SCALE RESPONSES TO CONTROL? (Y/N)? If YES is answered, then response spectrums will be scaled to the fixed PSD full scale value entered above. If NO is answered, then response plots will be AUTO-SCALED.

CONTROL FREQUENCY RANGE? (Y/N)? If YES is answered, then Spectral Data will be expanded to the SPECTRUM frequency range given in QUESTION 9. If NO is answered, then Spectral Data will be expanded to the DISPLAY FREQUENCY RANGE entered above.
NO RESPONSES TO STORE? Number of responses to be stored during tests. Up to 99 responses can be stored. The default number is seven.

TRANSMISSIBILITY REFERENCE?
BS,BD,SR Spectrum used as divisor for transmissibility displays. BS is the Standard Spectrum, BD is the Drive Spectrum and SR is a Stored Response.

TABLE 3-1 SD1200 Typical Test Definition Dialog

```
   ACTION              KEYBOARD
ABORT TTY STATE         Z(CNTRL Z)
DISPLAY MENU            DISPLAY
DEFINE NEW TEST         DEFINE
LIST CURRENT TEST       LIST
EDIT CURRENT TEST       EDIT
SAVE CURRENT TEST       SAVE
CHANGE TEST TIME        CHANGE

NOTE:  IF NEW TEST IS NOT DEFINED
THEN CURRENT TEST IS AS PREVIOUSLY
DEFINED

KEYWORD = DE

TEST NO. Ø
1 STARTING OUTPUT LIMIT (DB 1 VOLT ? 2Ø

2 TIMED TEST ?(Y/N)? Y

HOURS ? 1

MINUTES ? 1Ø

SECONDS ? 3Ø

3 RTA ANALYSIS RANGE(HZ) ? 2ØØØ

LINES ? 25Ø

NO. D.O.F.? 154
4 CONTROL ACCEL. SENSITIVITY (MV/G) ? 1ØØ

5 AUTO ?(Y/N)? Y

6 FIXED DRIVE OPTION ?(Y/N)? Y

7 PRE-TEST LEVELS (PTLS) in (-DB)
NO. OF PTLS ? 2

LEVEL ? 6

PTL TO GO RANDOM ? 2
STARTING LEVEL ? 2Ø
8 RMS ABORT
OVER TEST ? 3

UNDER TEST ? 3

9 SPECTRUM
STARTING FREQUENCY ? 5Ø

ENDING FREQUENCY ? 2ØØØ
EXTERNAL REFERENCE ? N
INIT SLOPE ? 3

FINAL SLOPE ? 12

NO. BRKPNTS ? 2

FOR BRKPNT NO. 1
FREQ? 1ØØ

AMPL ? .1

FOR BRKPNT NO. 2
FROM  1ØØ.Ø HZ TO ? 1ØØØ

AMPL ? .2

1Ø TOL AND ABORT SECTORS

NO. SECTORS ? 1

FOR SECTOR NO. 1
+ TOL ? 3

- TOL ? 3

+ ABORT ? 6

- ABORT ? 6

11 TEST IDENTIFICATION
TEST I.D. ? CONTRACT NO.  12345

GRAPH LABEL ? P/N 6789
12 GRAPHICS SETUP

AMPLITUDE SPAN(DB)? 3Ø

DISPLAY FREQUENCY RANGE
FROM(HZ)? 1ØØ

TO(HZ)? 15ØØ
FULL SCALE PSD VALUE?

SCALE RESPONSES TO CONTROL? (Y/N)?Y
CONTROL FREQUENCY RANGE? (Y/N)? Y
NO RESPONSES TO STORE?
TRANSMISSIBILITY REFERENCE?
BS,BD,SR>BS
   ACTION              KEYBOARD
ABORT TTY STATE         Z (CNTRL Z)
DISPLAY MENU            DISPLAY
DEFINE NEW TEST         DEFINE
LIST CURRENT TEST       LIST
EDIT CURRENT TEST       EDIT
SAVE CURRENT TEST       SAVE
CHANGE TEST TIME        CHANGE

NOTE:  IF NEW TEST IS NOT DEFINED
THEN CURRENT TEST IS AS PREVIOUSLY
DEFINED

KEYWORD = SA(CR)

THE TOTAL GRMS IS 14.29
```

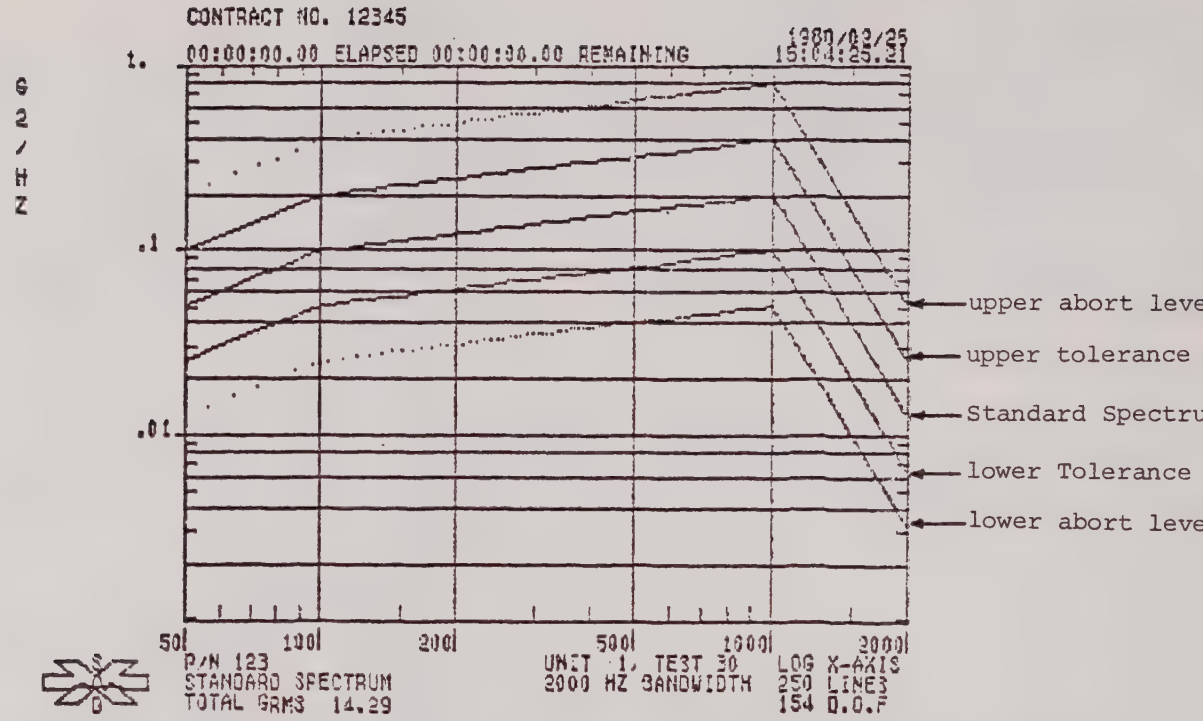


Figure 3-12 Standard Spectrum Defined by Test Dialog

LI (CR) - instructs the computer to list previously defined test parameters. The operator can elect to list the entire test or a particular line number as shown below:

ACTION	KEYWORD
ABORT TTY STATE	Z(CNTRL Z)
DISPLAY MENU	DISPLAY
DEFINE NEW TEST	DEFINE
LIST CURRENT TEST	LIST
EDIT CURRENT TEST	EDIT
SAVE CURRENT TEST	SAVE
CHANGE TEST TIME	CHANGE

NOTE: IF NEW TEST IS NOT DEFINED THEN CURRENT TEST IS AS PREVIOUSLY DEFINED

KEYWORD = LI

```
ALL ?(Y/N)? N
LINE NO. ?12
TEST NO. 30
12 GRAPHICS SETUP
AMPLITUDE SPAN(DB) 30
DISPLAY FROM  100 HZ
          TO 1000 HZ
CONTROL AMPLITUDE IS    1.0000
RESPONSES SCALED TO CONTROL
FREQUENCIES EXPANDED
CAN STORE UP TO   10 RESPONSES
BS IS THE TRANSMISSIBILITY REFERENCE
LINE NO.  ?-
```

The system prints the desired list, followed by KEYWORD = (the menu is not printed).

DI(CR) - instructs the computer to display the Test Definition Menu.

ED(CR) - will allow the operator to edit previously defined test parameters. The system asks the operator which line he wishes to edit by printing LINE NO? To exit the EDIT mode, the operator types N(CR) in response to LINE NO? The system then prints the menu.

```
          ACTION                KEYWORD
ABORT TTY STATE                  Z(CNTRL Z)
DISPLAY MENU                     DISPLAY
DEFINE NEW TEST                  DEFINE
LIST CURRENT TEST                LIST
EDIT CURRENT TEST                EDIT
SAVE CURRENT TEST                SAVE
CHANGE TEST TIME                 CHANGE
NOTE:  IF NEW TEST IS NOT DEFINED THEN
CURRENT TEST IS AS PREVIOUSLY DEFINED

     KEYWORD = ED

TEST NO.  30
LINE NO. ? 12
12 GRAPHICS SETUP
AMPLITUDE SPAN(DB)? 3Ø
DISPLAY FREQUENCY RANGE
FROM(HZ)? 1ØØ

TO(HZ)? 1ØØØ
FULL SCALE PSD VALUE ? 1
SCALE RESPONSES TO CONTROL ?(Y/N)? Y
CONTROL FREQUENCY RANGE ?(Y/N)? N
NO OF RESPONSES TO STORE ? 1Ø
TRANSMISSIBILITY REFERENCE?
BS,BD,SR > SR
LINE NO.?
```

SA(CR) - will save previously-defined test parameters. The system transfers the parameters to the test file, calculates and prints the grms value to the Standard Spectrum, and exits to the STOP state.

CH(CR) - will allow the operator to change only the test time. The computer will ask only question 2. When the change is completed, the system again prints the menu.

To abort the TTY state, the operator types CTRL and Z simultaneously, then strikes (CR). If test parameters have not been edited, the system automatically exits to the STOP state. If test parameters have been edited and not saved, the system prints:

DO YOU WISH TO SAVE EDIT SESSION ?(Y/N)?

If the operator types N(CR), the system automatically exits to the stop state without updating the test parameters. If a Y(CR) is typed, the system performs a SAVE to store the changes and exits to the STOP state.

3.7.4 RUNNING THE TEST

3.7.4.1 Selecting Test Number

To select a test, the operator toggles the ENTER switch after setting the FUNCTION switch to 00 and the ENTER DATA switch to the desired test number as indicated in the TEST SETUP MENU.

3.7.4.2 Starting the Test

There are three ways of starting and running a test. Pressing the start button initiates a short diagnostic routine, resets the test timer, and outputs the standard spectrum. The standard spectrum starting level for the first equalization is as defined in the test dialog.

Pressing either the AUTO or MANUAL toggle bypasses the short diagnostics if the test has been run before and outputs the previously equalized drive signal at the prescribed starting level. This is particularly useful when it is desired to get to a full test condition as soon as possible. If AUTO is pressed, then the system will progress through the pretest levels automatically, if MANUAL is pressed, then the system will stay at the lowest pretest level until the UP toggle is pressed. In either case, if the test has not run before the system automatically does the short diagnostic before proceeding to the start level.

Pressing the UPDATE or FIXED toggle initiates a smooth transition from the stop state to a full test condition bypassing the pretest levels, if the test has run before. If the test has not run before, then the system goes through the start state first, acting as if the start button was pushed.

Going through the start state always resets the test timer. Going to the equalize or full test state by either the MANUAL, AUTO, UPDATE or FIXED toggles does not reset the test timer if the test is being restarted.

3.7.5 On-Line Editing

One of the major advantages of SD1200 systems is the facility for on-line editing of control and display parameters without the need to interrupt the test in progress. The SD400 CONTROL/DATA DISPLAY group provides this capability. Subsequent paragraphs combine the operating instructions and menus which define the various data and control parameters that can be displayed and/or edited via the system graphics terminal.

NOTE

For operator convenience, expanded versions of the following menus are listed in Appendix B.

The Master Menu lists the other menus available. It is selected by dialing 70 on the DISPLAY switch and toggling the DISPLAY/STORE switch to DISPLAY. The operator may select any other menu desired by dialing the DISPLAY switch setting listed on the Master Menu and toggling the DISPLAY/STORE switch to DISPLAY.

*** MASTER MENU ***	
DISPLAY SW.	MENU
70	MASTER MENU
71	DATA MENU
72	TEST PARAMETER DIALOG MENU
73	PLOTTER CALIBRATION MENU
74	TEST PROFILE MODIFICATION MENU
75	TWO POINT PROFILE MODIFICATION MENU
76	DATA CURSOR CONTROL MENU
77	DATA DISK DIRECTORY MENU
78	TEST SETUP MENU
79	ALL MENUS
80	STOP CODE LIST

3.7.5.1 All Menus

When the DISPLAY switch is set to 79 and the DISPLAY/STORE switch is toggled to DISPLAY, all other menus will be sequentially displayed. Pages will over write and the operator must type CONTROL S (displayed as^S) to stop the display. To continue the display, the operator types CONTROL Q (displayed as ^Q).

3.7.5.2 Individual Menus

To display a single menu, the operator simply dials the menu number on the DISPLAY switch and toggles the DISPLAY/STORE switch to DISPLAY. Where applicable, adjustments may be made to edit control or data parameters on line. The following discussions and tables provide examples of how the various test and control parameters may be displayed and edited.

3.7.5.3 Test Setup Menu (78)

TEST SETUP MENU	
FUNCTION SWITCH	DATA ENTERED/DISPLAYED
00	SELECTED TEST NUMBER
01	SELECTED TEST NUMBER (WHILE RUNNING)
02	SD401 CHANNEL SENSITIVITY (MV/G)
03	EXTERNAL REFERENCE

Each of the functions listed in the TEST SETUP MENU are described in the following paragraphs.

SELECTED TEST NUMBER - Set the FUNCTION switch to 00, the ENTER DATA switch to the desired test number (01-99) and toggle the DISPLAY/STORE (D/S) switch to the DISPLAY position to select that test. The test number will appear in the TEST NO indicator.

SELECTED TEST NUMBER (WHILE RUNNING) - Set the FUNCTION switch to 01, the ENTER DATA switch to the desired test number and toggle the DISPLAY/STORE (D/S) switch to the DISPLAY poisition. This will cause the system to halt the current test and switch to the new selected test. The new test will begin at the lowest preset test level defined in it's test dialog using the current system transfer function to affect a quick equalization.

SD401 CHANNEL SENSITIVITY (MV/G) - This function is only used with the Multipoint Averaging (MPA) option described in Section V. The operator sets the FUNCTION switch to 02 and selects the desired channel (01-16) with the ENTER DATA switch. The computer will request MV/G via the system terminal when the D/S switch is toggled to the DISPLAY position. If the MPA option is not installed, the system will not respond.

EXTERNAL REFERENCE - The accelerometer signal or vibration input data can be designated as the reference signal. To select the input signal as the reference, the FUNCTION switch is set to 03 and the D/S switch is toggled to the STORE position. The external reference signal will appear on the graphics terminal when the D/S switch is toggl to DISPLAY.

3.7.5.4 Data Menu (71)

DATA MENU

DISPLAY SWITCH	DATA DISPLAYED	
00	POWER SPECTRUM DENSITY OF SELECTED INPUT CHANNEL	*
01	STANDARD SPECTRUM PROFILE	
02	DRIVE SPECTRUM PROFILE	
03	ERROR SPECTRUM (CONTROL SPECTRUM/STANDARD SPECTRUM)	
04	TIME DOMAIN DRIVE SIGNAL (+ or - 3 SIGMA MAXIMUM AMPLITUDE)	
05	POWER TRANSMISSIBILITY (INP/STD, INP/DRIVE, OR INP/STORED)	*
06	AMPLITUDE TRANSMISSIBILITY	*
07	STORED RESPONSE	**

* NOTE-SET ENTER DATA SWITCH TO THE DESIRED SD401 CHANNEL NUMBER

** Set ENTER DATA switch to the desired response, setting zero will display the last response.

POWER SPECTRUM DENSITY OF SELECTED INPUT CHANNEL - to display a Power Spectral Density (PSD) plot of the input signal, set the DISPLAY switch to 00 and toggle the D/S switch to DISPLAY. For systems with multiple channels set the ENTER DATA switch to the desired SD401 channel number. To store the current PSD input signal toggle the D/S switch to STORE. PSD responses will be sequently stored as RECORD numbers on the Data Disk. The RECORD NO. indicator will display the number as it is being stored and that RECORD NO. will also be printed at the top of the plot as shown in Figure 3-13. With the WINDOW/GRID (TEST SET UP GROUP) OFF, more than one stored response may be displayed and plotted on a single graph as shown in Figure 3-13. Pre-test responses 3 and 4 were stored while the system was equalizing at those levels. Figure 3-14 shows the final response for RECORD # 4 with the GRID switch ON.

STANDARD SPECTRUM PROFILE - to display the Standard Spectrum profile as defined in the test definition dialog, set the DISPLAY switch to 01 and toggle the D/S switch to DISPLAY. Plots of a typical standard Spectrum with and without a GRID are shown in Figures 3-15 amd 3-16.

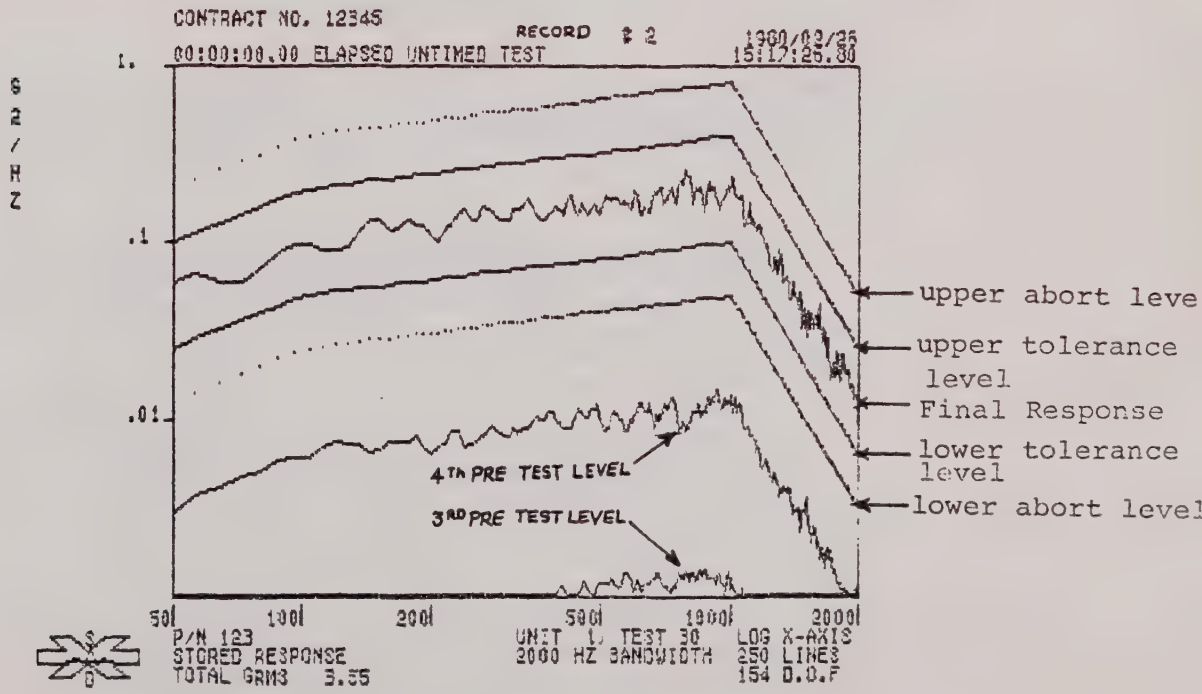


Figure 3-13 Pre-Test Levels and Final Response

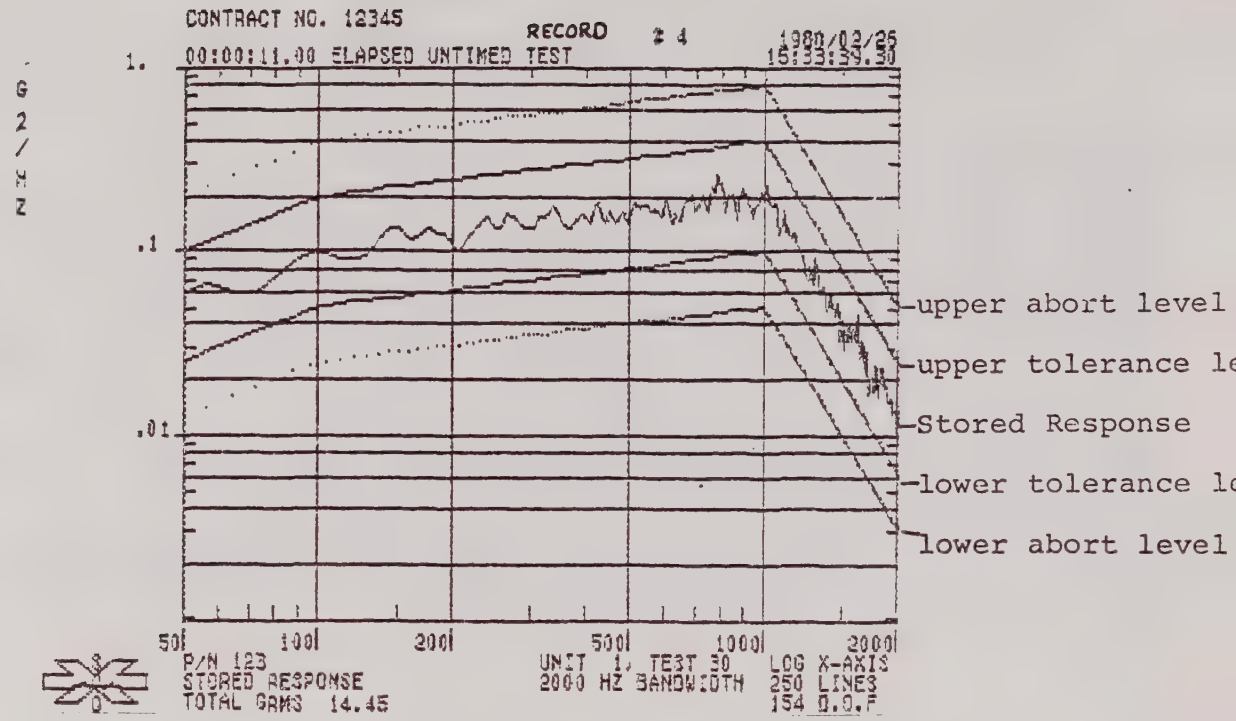


Figure 3-14 Final Stored Response

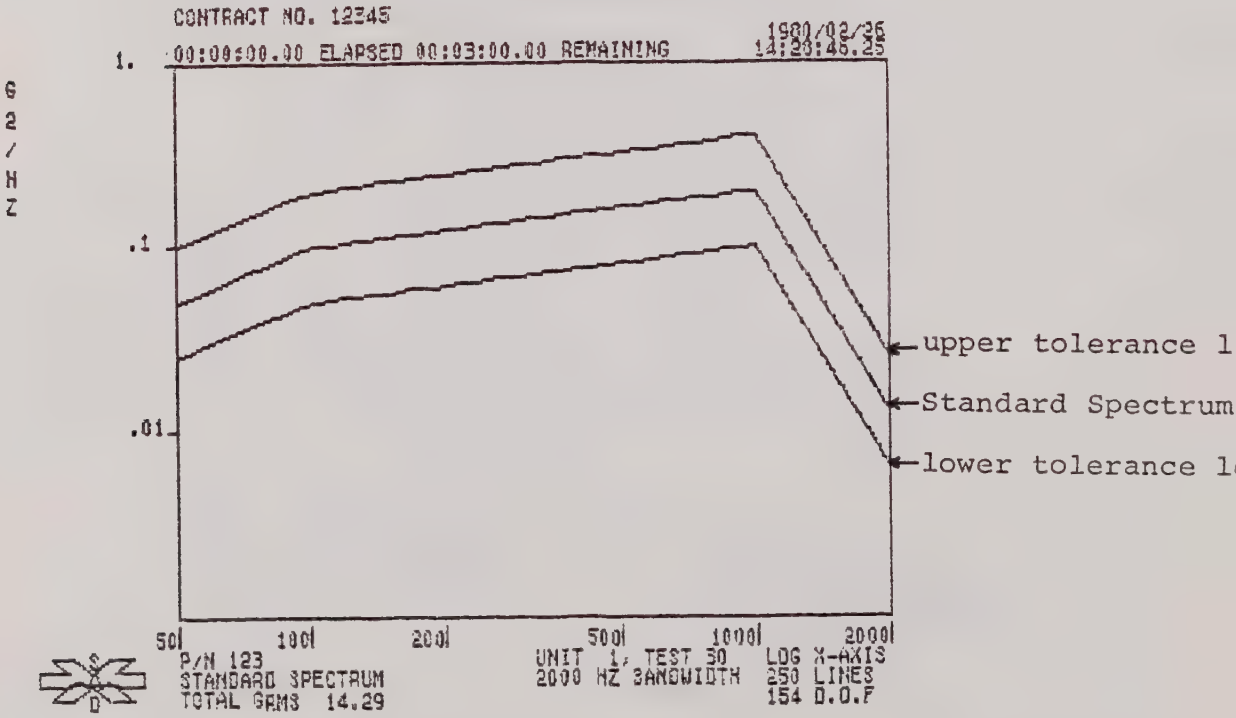


Figure 3-15 Standard Spectrum Profile with Grid switch OFF

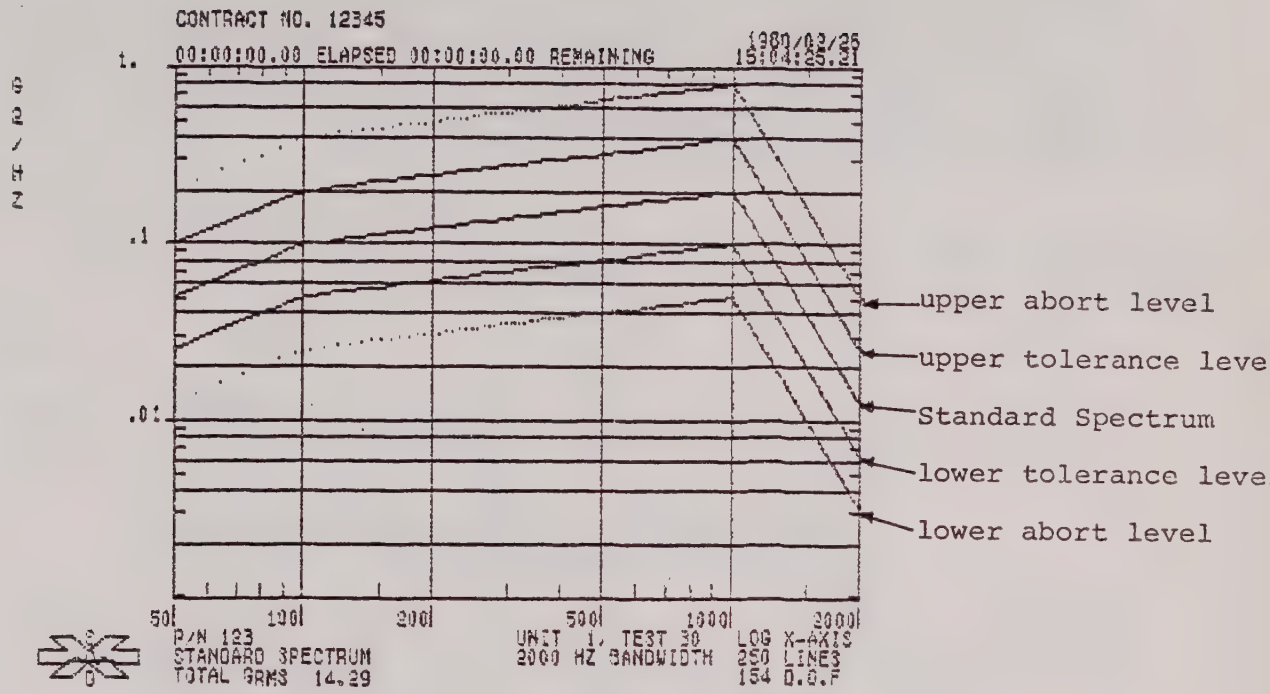


Figure 3-16 Standard Spectrum Profile with Grid switch ON

DRIVE SPECTRUM PROFILE - the Drive Spectrum is the signal applied to the shaker system. To display the Drive Spectrum, set the DISPLAY switch to 02 and toggle the DISPLAY switch to DISPLAY. The DRIVE SPECTRUM is always referenced to OdB as shown in Figure 3 - 17.

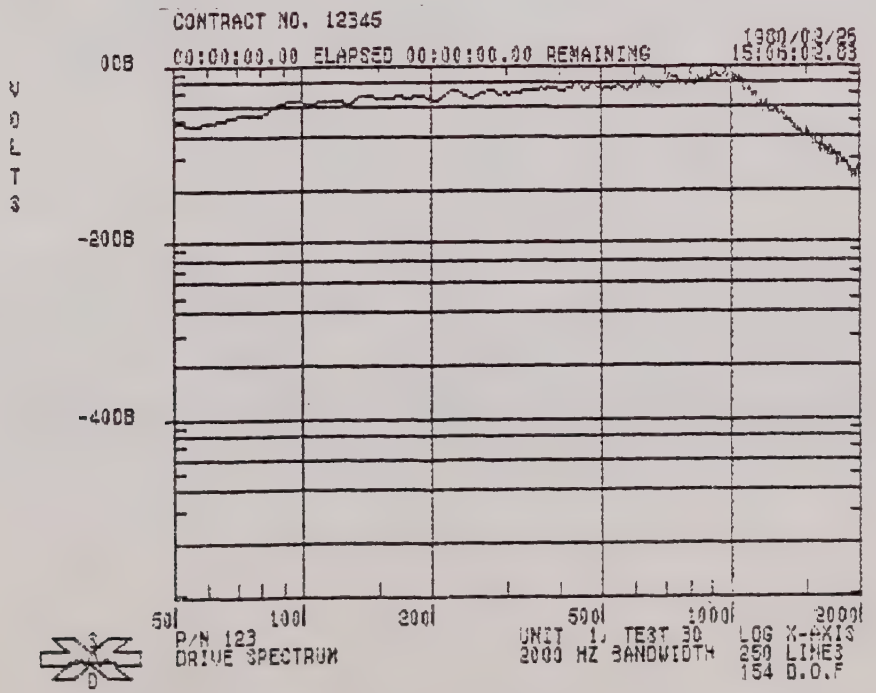


Figure 3-17 Drive Spectrum Profile

ERROR SPECTRUM - the ERROR SPECTRUM is the Control Spectrum divided by the Standard Spectrum, where the Control Spectrum is the response of the control accelerometer or other reference source; i.e., averaged inputs. For a display of the ERROR SPECTRUM, set the DISPLAY switch to 03 and toggle the D/S switch to DISPLAY. When the Control Spectrum or response is equal to the Standard Spectrum the display will show a horizontal line with an amplitude value of 1.

TIME DOMAIN DRIVE SIGNAL - for a display of the Time Domain Drive signal set the DISPLAY switch at 04 and toggle the D/S switch to DISPLAY. Figure 3-18 shows the plot of a Time-Domain Drive signal.

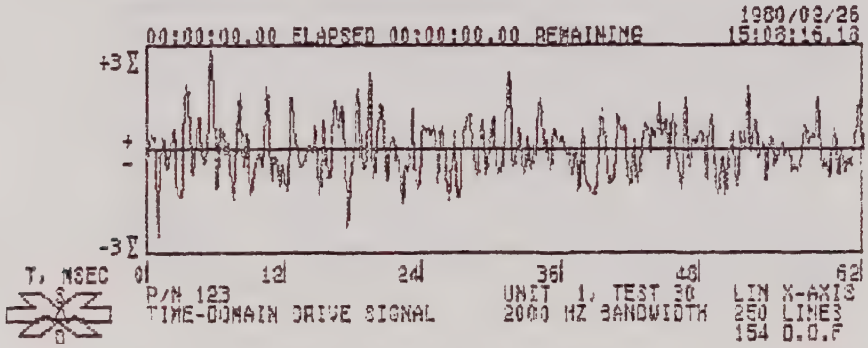


Figure 3-18 Time-Domain Drive Signals

POWER TRANSMISSIBILITY - Transmissibility is a measure of how well the Drive Signal is transmitted through the shaker system. A peak indicates a mechanical resonance. Vibrations that have an anti-resonant affect will absorb energy and be displayed as transmission losses at those frequencies. The above information is essential when performing vibration analysis. Transmissibility as defined here is the ratio of the input signal (INP) to the Standard Spectrum (STD), Drive Spectrum (DRIVE or DR), or Stored Spectrum (STORED or SR). The STD, DRIVE or STORED signal is defined as the Transmissibility Reference. In the test dialog, the Standard Spectrum is abbreviated as BS, the Drive Spectrum as BD and the Stored Spectrum as SR. Before measuring Power Transmissibility, the Transmissibility Reference must be selected from the Plotter Calibration Menu (section 3.7.5.6) or via TTY dialog. To select the reference, set the FUNCTION and DISPLAY switches to 26 and toggle the DISPLAY STORE switch to DISPLAY. The computer response readout will display the current reference (01 (STD),02 (DR), or 03 (SR)). To change the reference number, toggle the ENTER joystick up or down. Store the new reference number by toggling the DISPLAY/STORE switch to STORE.

To measure Power Transmissibility, set the DISPLAY switch to 05. The ENTER DATA switch selects the Transmissibility numerator and the denominator was selected from the Calibration Menu as described above. The setting of the ENTER DATA switch depends on whether the system is in the RUN or STOP mode. To help illustrate and summarize the following discussion, the reader should refer to the following tables. The tables show the SD400 switch settings, Transmissibility Reference (TRANS. REF.), and the resultant transmissibilities (TRANS. RESULT) for various modes of operation.

RUN MODE

FUNCTION SWITCH	ENTER DATA SWITCH	DISPLAY SWITCH	TRANS. REF.	TRANS. RESULT
NO EFFECT	Selects Input(INP)	05	STD(01)	INP/STD
NO EFFECT	Selects Input(INP)	05	DR (02)	INP/DR
Selects SR#	Selects Input(INP)	05	SR (03)	INP/SR#

STOP MODE

NO EFFECT	Selects SR#	05	STD(01)	SR#/STD
NO EFFECT	Selects SR#	05	DR (02)	SR#/DR
Selects SR#	Selects SR#	05	SR (03)	SR#/SR#

When the system is running and the SD401 Channel Selector option is installed, the ENTER DATA switch selects the desired channel. In a single channel system, the same input (INP) is always used in the ratio and the ENTER DATA switch has no effect. In the stop mode, the ENTER DATA switch selects a Stored Response (SR). In either the RUN or STOP mode the FUNCTION switch has no effect when the Transmissibility Reference is STD(01) or DR (02). When the reference is SR (03), the FUNCTION switch selects a Stored Response (SR#). Thus, in the STOP mode two Stored Responses can be compared.

AMPLITUDE TRANSMISSIBILITY - the explanation for POWER TRANSMISSIBILITY also applies to AMPLITUDE TRANSMISSIBILITY. The only difference between the two is the units of measurement. To measure AMPLITUDE TRANSMISSIBILITY, set the DISPLAY switch to 06 instead of 05 and follow the procedure outlined under POWER TRANSMISSIBILITY.

STORED RESPONSE - response profiles are sequentially stored in RECORD numbers. The RECORD number is displayed in the RECORD NO. readout when it is stored. To display a Stored Response (SR), set the DISPLAY switch at 07, and select the desired response (00-99) with the ENTER DATA switch, and toggle the DISPLAY/STORE switch to DISPLAY. The "last" or current response will be displayed when the ENTER DATA switch is set at 00.

3.7.5.5 TEST PARAMETER DIALOG MENU (72)

TEST PARAMETER DIALOG MENU

DISPLAY & FUNCTION SWITCH	PARAMETER DISPLAYED OR STORED
10	DEGREES OF FREEDOM
11	OVERTEST LIMIT
12	UNDERTEST LIMIT
13	NUMBER OF PRETEST LEVELS
14	VALUES OF PRETEST LEVELS
15	START LEVEL IN DB
16	MINIMUM EQUALIZATION TOLERANCE

All of the parameters listed above are displayed in the COMPUTER RESPONSE indicator by setting the FUNCTION and DISPLAY switches to the desired value and toggling the DISPLAY/STORE (D/S) switch to DISPLAY.

DEGREES OF FREEDOM - degrees of freedom (DOF) is a measure of statistical certainty in the Response Spectrum. The higher the DOF, the greater the statistical degree of certainty or control accuracy. For example, a DOF of 154 will yield a Response Spectrum control accuracy of + 1 dB.

OVERTEST LIMIT - when the RMS (dB) value of the Response Spectrum is XdB greater than the Standard Spectrum, the system will abort and a STOP code will be displayed. To change the value of the overtest limit, toggle the ENTER joystick to the desired value. Store the new value, by toggling the D/S switch to STORE.

UNDERTEST LIMIT - the description of the UNDERTEST LIMIT is the same as described above for the OVERTEST LIMIT with the exception of the value of the parameter and the switch settings.

NUMBER OF PRETEST LEVELS - up to four different pretest levels can be defined at any level relative to full test level. These pretest levels are specified in the test definition dialog.

VALUES OF PRETEST LEVELS - set the ENTER DATA switch to the desired pretest level (01-04) and the FUNCTION and DISPLAY switch to 14. The parameter can be modified with the ENTER joystick and the new value stored with the D/S switch. The pretest values are specified as dB levels below the full test level.

START LEVEL IN DB - The starting level given in dB below full test level is specified in the test dialog.

MINIMUM EQUALIZATION TOLERANCE - the Minimum Equalization Tolerance is the statistical degree of certainty (accuracy) to which the system must equalize before it goes to the next test level. A typical minimum Equalization Tolerance or control accuracy is + 1 dB and is given by the following equation:

$$\text{CONTROL ACCURACY} = 20 \log (1 + \sqrt{2/\text{DOF}})$$

where DOF = Degrees of Freedom

3.7.5.6 PLOTTER CALIBRATION MENU (73)

PLOTTER CALIBRATION MENU

DISPLAY & FUNCTION SWITCHES	PARAMETER DISPLAYED
20	PLOTTER CALIBRATION
21	GRAPHIC DISPLAY MODE
22	GRAPHIC DISPLAY AMPLITUDE SPAN
23	MINIMUM ZOOM FREQUENCY
24	MAXIMUM ZOOM FREQUENCY
25	FULL-SCALE PSD AMPLITUDE (IN G SQUARED/HERTZ)
26	TRANSMISSIBILITY REFERENCE

PLOTTER CALIBRATION - setting the DISPLAY and FUNCTION switches to 20 and toggling the DISPLAY/STORE switch to DISPLAY will allow the operator to position an X-Y plotter pen and calibrate the plotter at that point. For example, to calibrate the upper right hand corner of the plotter, toggle the ENTER joystick to the upper right and adjust the X and Y span controls to position the pen to the desired full-scale amplitude and frequency point.

GRAPHIC DISPLAY MODE - By setting the DISPLAY and FUNCTION switches to 21, the operator puts the system in the Graphic Display Mode. With the system in the Graphic Display Mode the plotter receives X and Y range information which defines the minimum and maximum plot frequencies and amplitudes. Toggling the DISPLAY/STORE switch to DISPLAY will cause CCCC to appear in the Computer Response display. Repeatedly toggling the ENTER joystick will change the display mode from CCCC to CCAA, then EECC and finally EEAA. One more toggle returns the display to CCCC.

The first two characters (CC or EE) represent the X-axis frequency range and the last two characters (CC or AA) represent the Y-axis amplitude range. The CC stands for CONTROL, the EE for EXPAND, and the AA stands for AUTO scale. With the system in the CONTROL (CC) mode, frequency and amplitude range are selected in accordance with the values specified in the Test Definition Dialog (question 9). When the system is in the EXPAND (EE) or AUTO scale (AA) mode, frequency (X) and amplitude (Y) ranges are scaled with reference to the ZOOM frequencies and maximum amplitude values present in that Response Spectrum.

The various ENTER modes and their functions are tabulated below:

CCCC Provides plotter calibration inputs corresponding to the control bandpass frequency and g /Hz amplitude as defined in the Standard Spectrum described in the Test Definition Dialog.

CCAA Provides plotter calibration inputs corresponding to the control bandpass frequency and the actual maximum amplitude contained in the spectrum to be plotted.

EECC Provides plotter calibration inputs corresponding to the ZOOM frequencies and the g^2/Hz amplitude as defined in the Standard Spectrum.

EEAA Provides plotter calibration inputs corresponding to the ZOOM frequencies and the actual maximum amplitude contained in the spectrum to be plotted.

GRAPHIC DISPLAY AMPLITUDE SPAN - setting the DISPLAY and FUNCTION switches to 22 and toggling the D/S switch to DISPLAY causes the GRAPHIC DISPLAY AMPLITUDE SPAN (dB) to be displayed in the COMPUTER RESPONSE readout. The operator may change the value via the ENTER joystick. To store the new value, toggle the D/S switch to STORE.

MINIMUM ZOOM FREQUENCY - Used in the "EE" mode, the Minimum Zoom Frequency defines the lowest frequency which is displayed. The display frequency range can be less then the test spectrum frequency range.

MAXIMUM ZOOM FREQUENCY - used in the "EE" mode, the Maximum Zoom Frequency defines the highest frequency which is displayed.

FULL-SCALE PSD AMPLITUDE (G SQUARED/HZ) - used in the "CC" mode, this parameter limits the amplitude of the Response Spectrum that can be displayed. Any frequency components that exceed this limit will be clippe

TRANSMISSIBILITY REFERENCE - set the FUNCTION and DISPLAY switches to 26 and the ENTER DATA switch to the desired reference as follows: 01 for Standard Spectrum (BS), 02 for Drive Spectrum (BD), or 03 for Stored Spectrum (SR). The Transmissibility Reference is used in conjunction with the Power and Amplitude Transmissibility measurements shown in the DATA MENU. To save this reference, toggle the D/S switch to SAVE.

3.7.5.7 TEST PROFILE MODIFICATION MENU (74)

TEST PROFILE MODIFICATION MENU

DISPLAY & FUNCTION SWITCH	PARAMETER DISPLAYED OR MODIFIED
30	G SQUARED PER HERTZ LEVEL AT CURSOR LOCATION
31	UPPER TOLERANCE LIMIT IN DB, AT CURSOR LOCATION ON STANDARD SPECTRUM
32	LOWER TOLERANCE LIMIT AT CURSOR LOCATION (IN DB)
33	UPPER ABORT LIMIT AT CURSOR LOCATION (IN DB)
34	LOWER ABORT LIMIT AT CURSOR LOCATION (IN DB)
35	FREQUENCY AT CURSOR LOCATION (IN HERTZ)
36	SPECTRUM LEVEL (IN GRMS)

To activate the display, set the DISPLAY and FUNCTION switches to the desired value and toggle the D/S switch to DISPLAY. For switch settings 30 through 35, move the cursor to the desired frequency via the ENTER joystick (horizontal toggle). The level of the parameter is then modified via the ENTER joystick (vertical toggle), and the new values are stored via the D/S switch. To display the spectrum level (GRMS), set the switches to 36 and toggle the D/S switch to DISPLAY.

3.7.5.8 TWO-POINT PROFILE MODIFICATION MENU (75)

TWO POINT PROFILE MODIFICATION MENU

DISPLAY & FUNCTION SWITCH	PARAMETER DISPLAYED
40	G SQUARED LEVEL AT LEFT CURSOR LOCATION ON STANDARD SPECTRUM
	G SQUARED LEVEL AT RIGHT CURSOR LOCATION ON STANDARD SPECTRUM
41	UPPER TOLERANCE LEVEL AT LEFT CURSOR LOCATION (IN DB) UPPER TOLERANCE LEVEL AT RIGHT CURSOR LOCATION
42	LOWER TOLERANCE LEVEL AT LEFT CURSOR LOCATION
	LOWER TOLERANCE LEVEL AT RIGHT CURSOR LOCATION

DISPLAY & FUNCTION SWITCH	PARAMETER DISPLAYED
43	UPPER ABORT LEVEL AT LEFT CURSOR LOCATION
	UPPER ABORT LEVEL AT RIGHT CURSOR LOCATION
44	LOWER ABORT LIMIT AT LEFT CURSOR LOCATION
	LOWER ABORT LIMIT AT RIGHT CURSOR LOCATION
45	FREQUENCY (HZ) AT LEFT CURSOR LOCATION
	FREQUENCY (HZ) AT RIGHT CURSOR LOCATION

THE TWO-POINT PROFILE MODIFICATION MENU - involves the same parameters as the TEST PROFILE MODIFICATION MENU but provides two cursors, permitti modification of an entire section of the test profile. That is, the modification mode applies not just at the cursor locations, but at all points between them.

To modify a STANDARD SPECTRUM section, set the switches to 45 and activa the display. The value of the left-hand cursor will appear in the COMPU RESPONSE readout. Toggle the ENTER joystick horizontally to change the left-hand cursor to the desired lower frequency location. To store that value, toggle the D/S switch to SAVE. To display the right-hand cursor, toggle the D/S switch to DISPLAY. Toggle the ENTER joystick horizontall to the desired upper frequency. To store the value, toggle the D/S switch to STORE.

To modify an amplitude value, set the switches to the desired value (40 through 44) and activate the display. Toggle the ENTER joystick vertically to the desired amplitude level for the left-hand cursor. To save the value, toggle the D/S switch to SAVE. To modify the right-hand cursor amplitude, toggle the D/S switch to DISPLAY and repeat the above procedure.

3.7.5.9 DATA CURSOR CONTROL MENU (76)

DATA CURSOR CONTROL MENU

DISPLAY & FUNCTION SWITCH	PARAMETER DISPLAYED
50	FREQUENCY DATA (IN COMPUTER RESPONSE READOUT)
	FREQUENCY CURSOR ON GRAPHICS DISPLAY
	PLOTTER PEN SET TO FREQUENCY CURSOR LOCATION

DISPLAY & FUNCTION SWITCH	PARAMETER DISPLAYED
51	AMPLITUDE DATA (IN COMPUTER RESPONSE READOUT) AMPLITUDE CURSOR ON GRAPHICS DISPLAY PLOTTER PEN SET TO AMPLITUDE CURSOR LOCATION

FREQUENCY DATA - with the DISPLAY and FUNCTION switches set at 50, a cursor will appear on the graphics terminal. The frequency of the cursor, which can be moved with the ENTER joystick, is displayed in the COMPUTER RESPONSE readout. If a plotter is used, the ENTER joystick will control the movement of the plotter's pen.

AMPLITUDE DATA - with the exception of the measurement units, this parameter functions as described above.

3.7.5.10 DATA DISK DIRECTORY MENU

DATA DISK DIRECTORY MENU (77)

DISPLAY SWITCH	DISPLAY
60	LISTING OF TEST FILES ON DATA DISK
61	LISTING OF CURRENT TEST'S STORED DATA

LISTING OF TEST FILES ON DATA DISK - a listing of the Data Disk's test numbers and dates created can be displayed with this menu. The number of responses to be recorded is defined in the test dialog. The default number of responses recorded is seven.

LISTING OF CURRENT TEST'S STORED DATA - this setting will list the test numbers (01-99), the number of records for each test number, and the remaining records available.

3.7.6 RECORDING THE TEST RESULTS

Test results are recorded (STORED) with the aid of the DATA MENU. With reference to the DATA MENU, any time the D/S switch is toggled to STORE and the DISPLAY switch is set to 00 through 09 the Response Spectrum (profile) will be STORED (recorded). The number of test profiles to be stored is defined in the test dialog. The default number is seven.

3.8 SYSTEM SOFTWARE UTILITIES

When the system is received, the computer memory contains neither test programs nor system diagnostics. These programs are loaded via the system terminal.

3.8.1 Loading RT-11 Program

The PDP 11 Computer has no programmer's console. Instead, it has a Bootstrap/Terminator module with a stored Console Emulator routine. The computer startup sequence consists of the following steps:

a. Insert the System Disk (program) into Drive 0.
b. Insert the Data Disk into Drive 1.
c. Set the DC switch on the PDP 11 Operator's Console to ON. The front panel DC indicator will light.
d. Set the HALT/CONT switch on the Operator's Console to CONT.
e. The power amplifier should be OFF or at minimum gain since transients may be generated by this operation. Toggle the BOOT/INIT switch on the Operator's Console to INIT and release it. It will return to the BOOT position and the RUN indicator will light. This step initializes the processor, clears the peripheral registers and starts the Console Emulator routine.

When the Console Emulator routine starts, the system terminal prints four sets of octal numbers (6 digits each), followed by a dollar sign, as shown below.

```
000400    012450    000546    004054
$
```

The system is now ready for booting to load the program.

CAUTION

Toggling the BOOT/INIT switch while running a program will abort that program and may damage the shaker or test item. Contents of the general-purpose registers and memory may be lost.

3.8.2 Formatting a Blank Disk

NOTE

The storage device used in the following sections is a double-density Diskette (Floppy Disk). The device code is DYn, where n refers to the disk drive number. Table A-1 (Page A-3) in Appendix A lists the codes for other I/O devices.

a. With the System Disk in Drive Ø, boot the system to RT-11 MONITOR (as described in paragraph 3.7.2). If the system is already booted, type CTRL/C to return to RT-11 MONITOR (see CAUTION in paragraph 3.7.2).

b. Insert the blank disk to be formatted in Drive 1.

c. Start the Format program by typing:
R FORMAT(CR)
The system will print an asterisk (*).

d. Start formatting by typing:
DY1:(CR)
The system will print:
DY1:/FORMAT ARE YOU SURE? (NOTE: Formatting a disk erases any data that currently exists on the disk)

e. Proceed with formatting by typing:
Y(CR)
The system will format the disk in Drive 1, setting up 256-word blocks.

3.8.3 Initializing aFormatted Blank Disk

a. With the System Disk in Drive Ø, boot the system to RT-11 MONITOR (as described in paragraph 3.7.2). If the system is already booted, type CTRL/C to return to RT-11 MONITOR (see CAUTION in paragraph 3.7.2).

b. Insert the disk to be initialized in Drive 1.

c. Start initialization by typing:
INI/BAD DY1:(CR)
The system will print:
DY1:/INIT ARE YOU SURE?

NOTE
Initializing creates an empty directory making any data previously stored on the disk inaccessable without advanced programming techniques.

d. Proceed with initialization by typing:
Y(CR)
The system will test the disk in Drive 1 for bad blocks and initialize it by creating an empty directory. If the system cannot initialize the disk, a hard error exists and the disk should be discarded.

3.8.4 Listing Bad Blocks on a Blank Disk

a. With the System Disk in Drive Ø, boot the system to RT-11 MONITOR (as described in paragraph 3.7.2). If the system is already booted, type CTRL/C to return to RT-11 MONITOR

CAUTION
The terminal keyboard is enabled at all times. Typing CTRL/C during a test will smoothly stop all currently running tests and abort the program. Test data may be lost.

b. Insert the disk with bad blocks in Drive 1.
c. Start the listing of bad blocks by typing:
DIR/BAD DY1:(CR)
The system will print a list of the bad blocks on the disk in Drive 1.

3.8.5 Listing Disk Contents Alphabetically

a. With the System Disk in Drive Ø, boot the system to RT-11 MONITOR (as described in paragraph 3.7.2). If the system is already booted, type CTRL/C to return to RT-11 MONITOR (see CAUTION in paragraph 3.7.2).
b. Insert the disk to be listed in Drive 1.
c. Start the listing by typing:
DIR/ALP DY1:(CR)
The system will print an alphabetical list of the contents of the disk in Drive 1.

3.8.6 Copying a System Disk

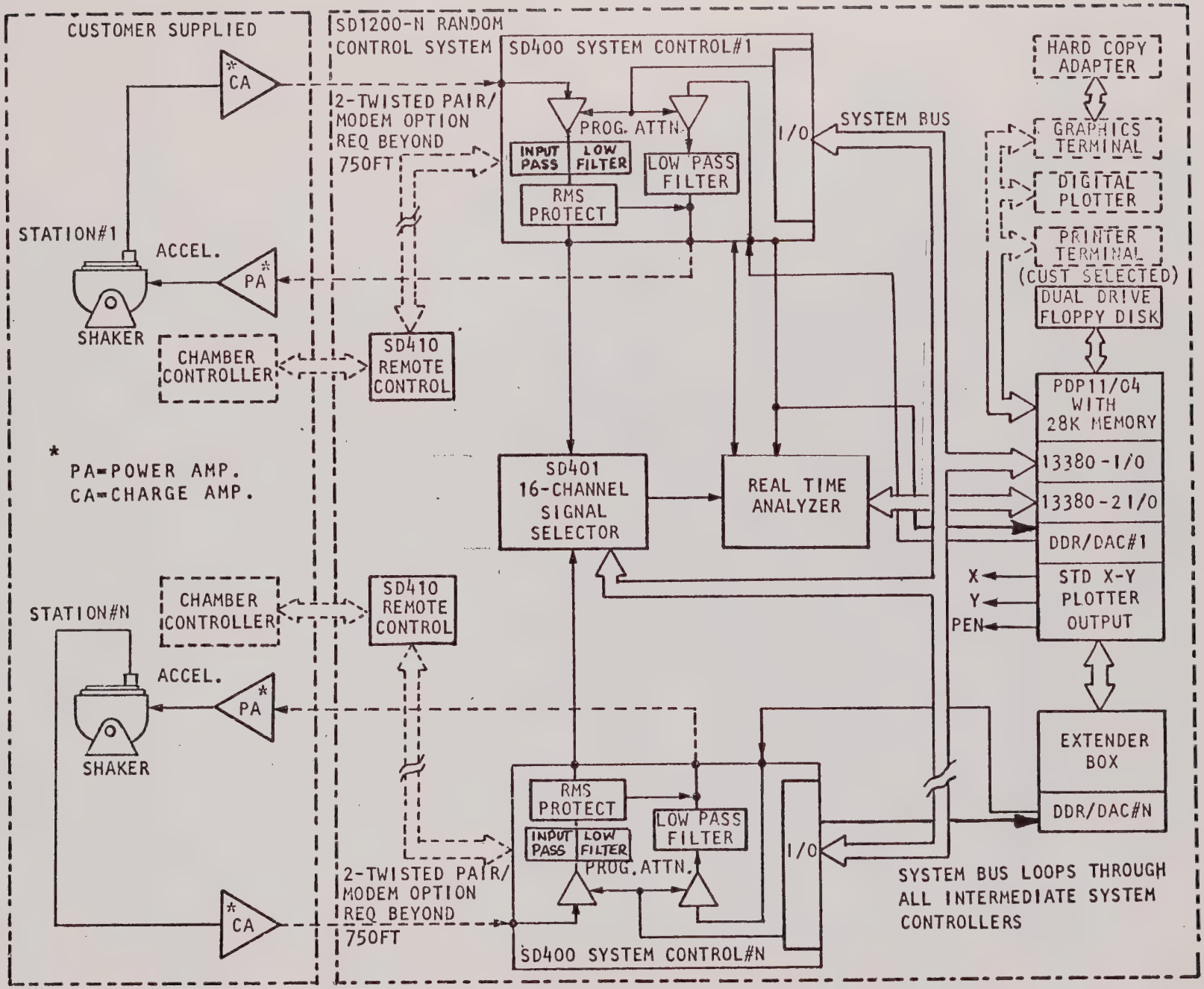
a. With the System Disk in Drive Ø, boot the system to RT-11 MONITOR (as described in paragraph 3.7.2). If the system is already booted, type CTRL/C to return to RT-11 MONITOR (see CAUTION in paragraph 3.7.2).
b. Insert an initialized blank disk in Drive 1.
c. Start copying by typing:
COP/DEV DYØ: DY1:(CR)
The system will print:
DY1:/COPY ARE YOU SURE?
d. Proceed with copying by typing:
Y(CR)
The system will copy the contents of the System Disk Drive Ø onto the disk in Drive 1.

SECTION IV
CONCEPT OF OPERATION

Figure 4-1 is a block diagram of an SD1200 System. It shows the various standard options and accessories that are available for central and remote control as well as some that can be included for plotting, displaying, or printing data.

Test and diagnostic programs are entered into computer memory from the System Disk via the disk drive. The reference input and test parameters are entered by the operator via the system terminal. From the reference input, the computer constructs a Standard Spectrum (BS) of frequency vs. amplitude values. This spectrum is stored on system disk, and is also used to generate the initial shaker Drive Spectrum (BD). This spectrum is converted by the Digital Data Randomizer/ Digital-to-Analog Converter (DDR/DAC) and the Inverse Fourier Transform (IFT) to an equivalent time-domain signal (BQ) used to drive the shaker. BQ is then routed to the System Control, where its frequency bandpass and rms amplitude are determined. Initially, the rms amplitude is limited to the minimum value that will produce a detectable control accelerometer output.

The response of the device under test to the excitation provided by the shaker is sensed by the control accelerometer. Its output is routed back to the System Control for conditioning and then to the Real-Time Analyzer (RTA) resulting in a response spectrum. A pre-determined (specified in the test dialog) number of these response spectra are accumulated in computer memory and averaged to provide a representative Response Spectrum (BR).


CUSTOMER SUPPLIED
SD1200-N RANDOM CONTROL SYSTEM
SD400 SYSTEM CONTROL#1
HARD COPY ADAPTER
GRAPHICS TERMINAL
DIGITAL PLOTTER
PRINTER TERMINAL
(CUST SELECTED)
DUAL DRIVE FLOPPY DISK
CA
2-TWISTED PAIR/ MODEM OPTION REQ BEYOND 750FT
PROG. ATTN.
INPUT PASS
LOW FILTER
LOW PASS FILTER
RMS PROTECT
I/O
SYSTEM BUS
STATION#1
ACCEL.
PA
SHAKER
CHAMBER CONTROLLER
SD410 REMOTE CONTROL
PDP11/04 WITH 28K MEMORY
13380-I/O
13380-21/O
DDR/DAC#1
STD X-Y PLOTTER OUTPUT
X
Y
PEN
SD401 16-CHANNEL SIGNAL SELECTOR
REAL TIME ANALYZER
PA=POWER AMP.
CA=CHARGE AMP.
STATION#N
EXTENDER BOX
DDR/DAC#N
SYSTEM BUS LOOPS THROUGH ALL INTERMEDIATE SYSTEM CONTROLLERS
SD400 SYSTEM CONTROL#N

Ideally, BR is (within Predetermined limits) equivalent to BS. In most cases, however, the mechanical response alters some spectral components of the drive signal (BQ) and the difference between BR and BS exceeds the predetermined limits. Consequently, it is necessary to compare BR, BS and BDold to calculate a corrected drive spectrum (BDnew). This correction of the drive spectrum is commonly called equalization. BDnew is used to generate a new BQ and the resulting PSEUDO-RANDOM BQ is sent to the DDR/DAC to generate the next random drive signal.

If equalization has been satisfactorily achieved, the amplitude of BQ is increased. Since the response of the mechanical system may differ at the new amplitude, equalization is again attempted.

The equalization process is repeated at successively higher drive signal levels until the specified test level is reached. The actual test may be run with the system in "open-loop" mode, with no further equalization; or in "closed-loop" mode, with equalization occurring each time the predetermined number of response spectra have been accumulated and averaged in the computer.

In its basic form, the system continuously displays the value to BR and has the capability of driving an optional plotter, printer, or graphics terminal on line or to reproduce test data after test completion. A graphics software package, included with the system, provides annotation of digitally plotted or displayed test data, and it is possible for the operator to inspect and edit test parameters while the system is operating on line.

SD1200 systems that control multiple shakers time share the computer and RTA. In these systems, the SD400 System Control includes an RMS Detector option. It continually monitors the corresponding shaker drive signal and shuts down the test if the specified abort levels are exceeded. Consequently, each shaker system is protected continuously, even through the computer is time shared.

Systems with Multi-point Averaging incorporate a Model SD401 Channel Selector. Thus, up to 16 accelerometer inputs may be scanned with the resulting spectra being captured and averaged by the computer.

SECTION V
MULTIPOINT AVERAGING OPTION

5.1 INTRODUCTION

Spectral Dynamics Model SD401 is incorporated in an SD1200 series Random Vibration System when the outputs of several accelerometers must be analyzed and averaged (Multipoint Averaged), when multishaker systems are employed or in systems combining both these requirements .

The SD401 is a 16-channel analog multiplexer designed to be computer controlled. It is used to select a single analog output from as many as 16 inputs. Inputs may be single-ended, grounded, or differential. The selected output is single-ended and grounded.

Figure 5-1 shows how the SD401 is used to multiplex accelerometers outputs from a single-shaker system. Multishaker systems are multiplexed by the SD401 as shown in Figure 5-2. These two configurations can be combined with SD401 Channel Selector's multiplexing accelerometers and SD400 System Control Units in a multishaker system. Thus, the SD401 permits time sharing of a single computer and Real Time Analyzer (RTA) in multishaker systems, thereby greatly reducing the per-shaker cost for complete analysis and control.

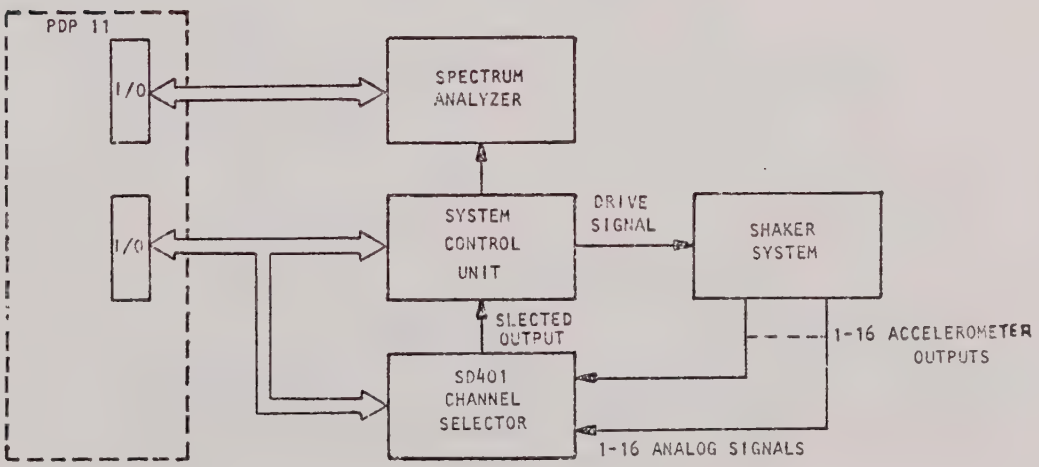


Figure 5-1 Multiplexing Accelerometer Outputs

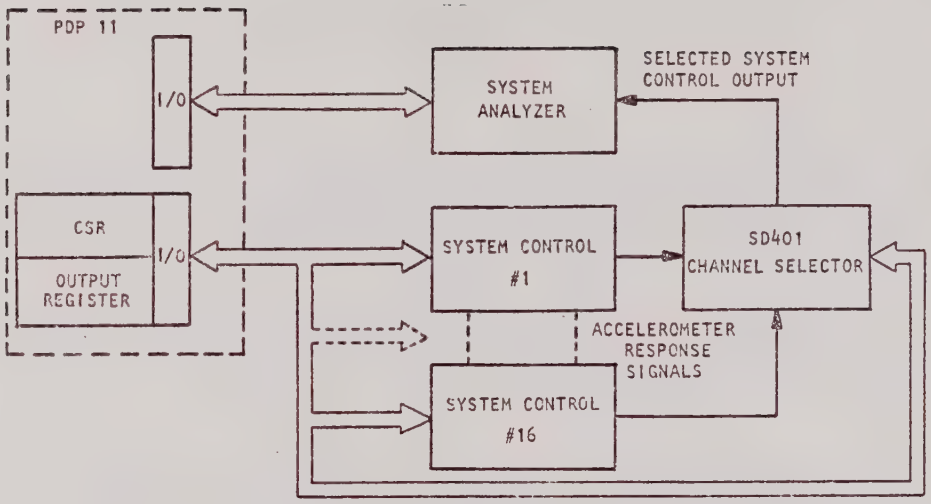


Figure 5-2 Multiplexing Shaker Systems

5.2 INSTALLATION

The SD401 Channel Selector mounts in a 19 inch rack. The units interconnect in a Multishaker system with Multipoint Averaging as shown in Figure 5-3. The SD401's may be "daisy chained" if more than 16 channels are desired. "Data Out" and "Control Out" connectors should be terminated (standard plugs supplied) on the last SD400 (J17,J19) and SD401 (J19,J21) in a "Daisy Chained" system.

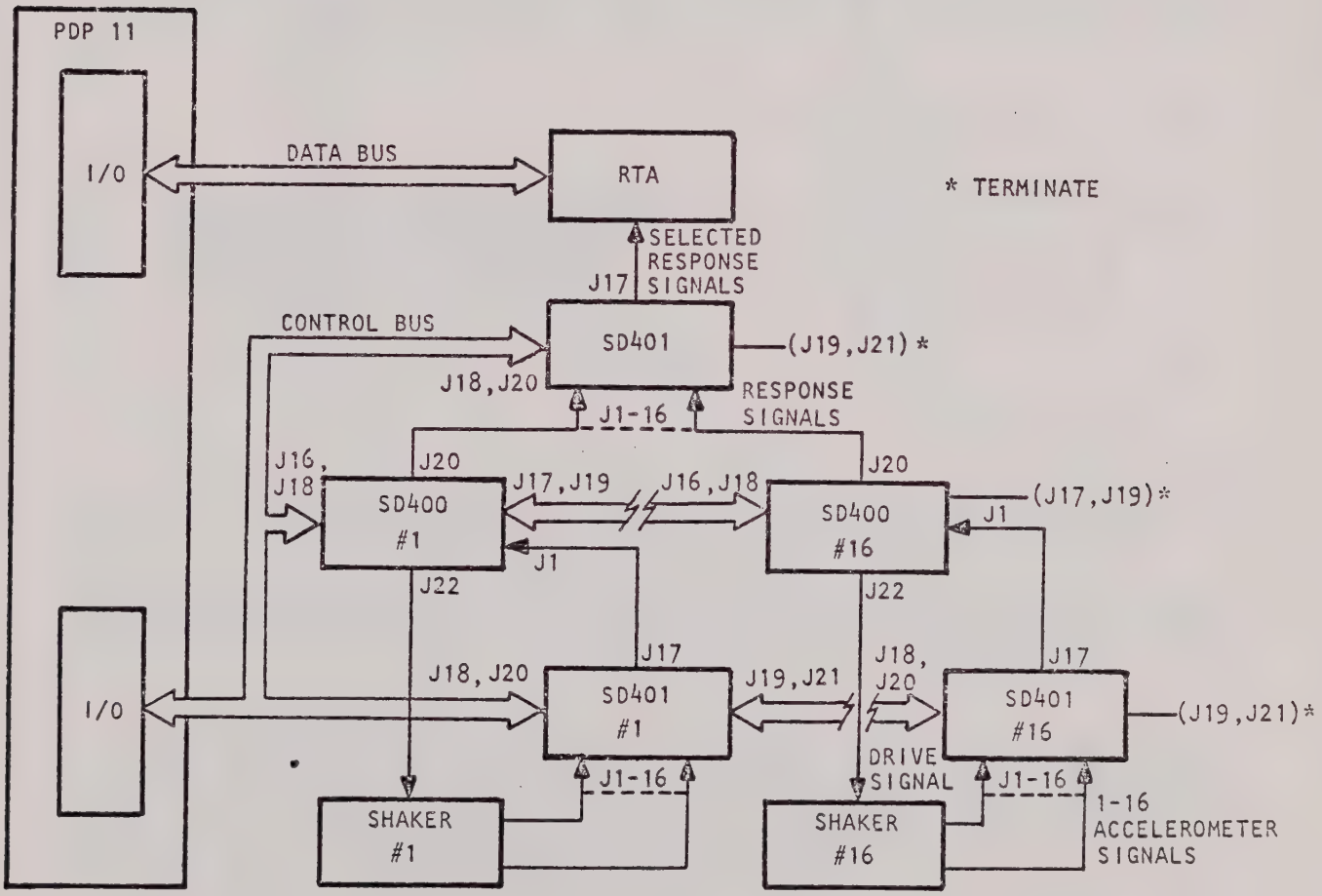
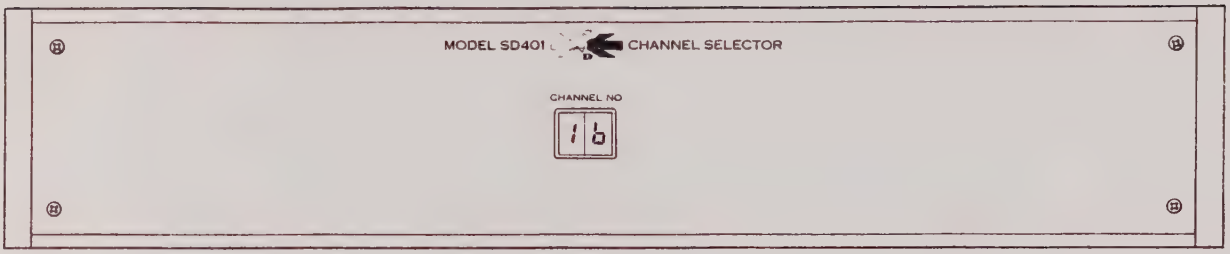


Figure 5-3 Multishaker SD1200 System with Multipoint Averaging

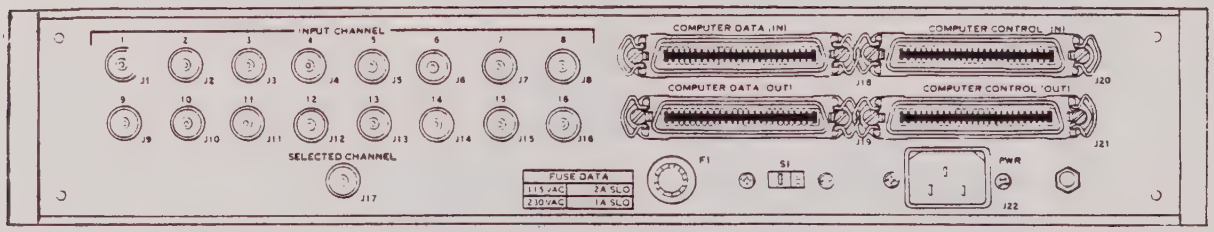
5.3 OPERATION

5.3.1 Front Panel Description



The SD401 has no front panel controls since all it's functions are programmed by the system computer. A two-digit numeric display is incorporated in the SD401 front panel. These seven-segment indicators display the number of the selected input being routed to the output.

5.3.2 Rear Panel Description



INPUT CHANNEL (J1-J16) - each BNC connector accepts an input from either an accelerometer when multipoint averaging or from an SD400 System Control Unit when installed in a Multishaker System.

SELECTED CHANNEL (J17) - provides a signal to the Real Time Analyzer (RTA) for controlling the shaker system. An individual channel may be selected or up to 16 inputs may be scanned and multipoint averaged to control the system.

COMPUTER DATA Connectors (J18 and J19) - there are two of these connectors, J18 and J19, computer data (IN) and COMPUTER DATA (OUT), respectively. J18 accepts data from the computer output register. These data signals consist of the channel address of the analog input to be selected. J18 also returns status data to the computer, verifying that the correct unit and channel have been selected. The COMPUTER (OUT) connector (J19) delivers outputs that correspond to the data at J18. These outputs may be "daisy-chained" to other SD401's or System Control Units in multishaker control systems. Table 5-1 shows the pin assignments for J18 and J19.

Table 5-1 Computer Data (In), J18 and Computer Data (Out) J19 Pin Assignments

PIN NO.	DESIGNATION	PIN NO.	DESIGNATION
1	GND	26	GND
2	COD-1	27	COD-0
3	COD-3	28	COD-2
4	COD-7	29	COD-6
5	COD-5	30	COD-4
6	COD-11	31	COD-10
7	COD-8	32	COD-9
8	COD-15	33	COD-14
9	COD-12	34	COD-13
10	GND	35	GND
11	NC	36	NC
12	NEW DATA RDY	37	COMP INIT
13	GND	38	NC
14	CID-2	39	GND
15	CID-5	40	CID-0
16	CID-4	41	CID-3
17	CID-7	42	CID-1
18	CID-8	43	CID-6
19	CID-11	44	CID-9
20	CID-13	45	CID-10
21	CID-12	46	CID-14
22	NC	47	CID-15
23	NC	48	GND
24	GND	49	NC
25	NC	50	NC

CID = Data to computer NC = NO CONNECTION COD = Data from computer

COMPUTER CONTROL Connectors (J20 and J21) - there are two of these connectors, J20 and J21, COMPUTER CONTROL (IN) and COMPUTER CONTROL (OUT), respectively. J20 accepts select command data from the computer Command Status Register (CSR) as well as the required control signals. These data signals provide the commands which determine the priorities of the various System Control Units in multishaker control systems.

The COMPUTER CONTROL (OUT) connector, J21, delivers outputs that correspond to the input control signals at J20 (note that signals at J21-17 and -18 complement signals at J20-17 and -18). These outputs may be "daisy-chained" to other SD401's. TABLE 5-2 and 5-3 respectively, show the pin assignments for J20 and J21.

Table 5-2. Computer Control (In), J20 Pin Assignments

Pin No.	Signal Designation	Pin No.	Signal Designation
1	GND	26	GND
2	CSR-2	27	CSR-3
3	CSR-1	28	CSR-0
4	CSR-6	29	CSR-7
5	CSR-5	30	CSR-4
6	CSR-10	31	CSR-11
7	CSR-9	32	CSR-8
8	CSR-14	33	CSR-15
9	CSR-13	34	CSR-12
10	NC	35	NC
11	NC	36	NC
12	READ DATA	37	GND
13	NC	38	GND
14	NC	39	GND
15	GND	40	NC
16	INT A ACTIVE	41	NC
17	PRIOR A +	42	NC
18	PRIOR B +	43	NC
19	NC	44	NC
20	NC	45	NC
21	NC	46	NC
22	GND	47	REQ A
23	REQ B	48	NC
24	GND	49	NC
25	NC	50	GND

CSR = Command Status Register NC = NO CONNECTION

Table 5-3. Computer Control (OUT), J21 Pin Assignments

Pin No.	Signal Designation	Pin No.	Signal Designation
1	GND	26	GND
2	CSR-2	27	CSR-3
3	CSR-1	28	CSR-0
4	CSR-6	29	CSR-7
5	CSR-5	30	CSR-4
6	CSR-10	31	CSR-11
7	CSR-9	32	CSR-8
8	CSR-14	33	CSR-15
9	CSR-13	34	CSR-12
10	NC	35	NC
11	NC	36	NC
12	READ DATA	37	GND
13	NEW DATA RDY	38	GND
14	NC	39	GND
15	GND	40	COMP INIT
16	INT A ACTIVE	41	NC
17	PRIOR A -	42	NC
18	PRIOR B -	43	NC
19	NC	44	NC
20	NC	45	NC
21	NC	46	NC
22	GND	47	REQ A
23	REQ B	48	NC
24	GND	49	NC
25	NC	50	GND

Command Status Register NC = NO CONNECTION

PWR (J22) - accepts 3-wire plug for applying 115/230 VAC, primary input power.

F1 (Fuseholder) - accepts a 3AG Slo-Blo fuse. The rating of F1 is 2 amps for 115 Vac and 1 amp for 230 Vac operation.

S1 (115/230 VAC Switch) - provides switching of primary input power circuits for either 115 VAC or 230 VAC operation. Proper input voltage to be applied is shown in switch window.

5.3.3 Principles of Operation

5.3.3.1 Introduction

Input selection is controlled by the system computer via the Computer Control outputs entering at J20. The channel to be selected is specified by the computer via the Computer Data outputs entering at J18. Connectors J19 and J21, respectively provide outputs corresponding to J18 and J20 inputs. These outputs may be routed to additional SD401's for "daisy-chained" operation.

5.3.3.2 SD401 Channel Selector Control Functions

The SD401 is designed to perform either of two system functions. They are:

a. To multiplex accelerometer outputs for analysis and averaging.
b. To multiplex individual shaker systems to permit time-sharing of a single computer and RTA.

The system software determines the sequence in which the various shakers will operate, the time allotted to each, and the times at which the various accelerometer signals will be transferred to the RTA.

Once the desired channel of the SD401 has been activated, data is routed back to the computer, verifying that the desired unit and channel have been selected.

All communication between the computer and the SD401 is conducted via a 13380 I/O Assembly located in the computer.

5.3.3.3 Unit Selection

Any system using an SD401, multiple SD400 System Control Units, and possibly one or more Remote Control Units requires unit selection. That is, the computer must be able to select each specific peripheral, whether it be an SD401 or some other device. The computer does this via the Command Status Register (CSR) by outputting a Select Command. This Select Command is routed to the SD401 for comparison to the setting of Unit Address Switch S1, located in the SD401. When the Unit Address and the Select Command are identical, the SD401 will decode the Channel Select data. Table 5-4 shows the various codes (32) that can be set via the SD401 Unit Address Switch.

Table 5-4. Unit Address Codes.

Switch States: Open = 1 Closed = 0					
Switch Section					Equivalent
5	4	3	2	1	Decimal No.
0	0	0	0	0	0
0	0	0	0	1	1
0	0	0	1	0	2
0	0	0	1	1	3
0	0	1	0	0	4
0	0	1	0	1	5
0	0	1	1	0	6
0	0	1	1	1	7
0	1	0	0	0	8
0	1	0	0	1	9
0	1	0	1	0	10
0	1	0	1	1	11
0	1	1	0	0	12
0	1	1	0	1	13
0	1	1	1	0	14
0	1	1	1	1	15
1	0	0	0	0	16
1	0	0	0	1	17
1	0	0	1	0	18
1	0	0	1	1	19
1	0	1	0	0	20
1	0	1	0	1	21
1	1	0	1	1	27
1	1	1	0	0	28

A system, then, could include a combination of up to 32 SD400 System Control or SD401 Channel Selector Units, each assgined its own Unit Address. Changing the assigned Unit Address codes or system interconnections of any of the foregoing assemblies would also require software changes to prevent chaos in the system.

SECTION VI
MULTI-SHAKER SYSTEMS

6.1 INTRODUCTION

This section describes SD1200 Series systems that consist of more than one shaker station. When expanding a system by adding an SD401 each additional station requires an SD400 System Control unit, RMS Detector, and a 13379-1 DDR/DAC. The RMS Detector is a plug-in assembly installed in the SD400 System Control Unit. During periods when the computer is servicing another station, the RMS Detector provides under-test and overtest protection. An abort condition is sensed every 100 M sec.

The upper limit of the system's bus structure permits control of up to 32 independent vibration testing stations. A hard disk is required for operation of over five stations. When over 16 stations are employed, an additional Model SD401 Channel Selector is required.

6.2 INSTALLATION

All the units mentioned can be installed in the field to expand a given basic system with a minimum of cost simply by the interconnection of cable assemblies. Discussions should be held with factory personnel when selecting additional support devices such as terminals, plotters, hardcopy units, printers and disks.

6.3 OPERATION

System operation is basically the same with multiple shakers as it is with a single shaker. In a multi-shaker system, the operator has only to toggle the DIALOG switch on the appropriate SD400 System Control Units and proceed as with a single shaker system.

Servicing of each shaker system occurs on a time-shared, "round-robin" basis. The operating system services an active shaker system by performing the required equalizations and analysis functions. The computer then looks to see if any other shaker station requires service. If another shaker requires service, that shaker station is serviced, if not, the same station is serviced again. Abort and manual stops are handled on an interrupt basis as they occur, smoothly shutting down that shaker system. The computer then returns to the system that was being serviced when the interruption occurred.

SECTION VII
REMOTE CONTROL OPTION

7.1 INTRODUCTION

There are many situations which require testing a structure or test item while generating and controlling the vibration enviroment at a remote test site. To have the most flexibility, control of the actual shaker excitation should be possible from the central testing location as well as from a control position right at the exciter. In this way, the test can be selected by an operator right at the shaker head, if desired. Control of the test at the exciter also permits an on-site operator to shut down the test if there is a visual or acoustical indication of a poor test condition.

Spectral Dynamic's Model SD410 Remote Control option allows two way communication between the shaker station and the SD400 System Control unit. This option permits communication in RS-232C format via twisted pair for distances up to 750 feet. For distances beyond 750 feet, a 1200-baud, full-duplex telephone MODEM interface may be added. The SD410 can control the test, or interface to an environmental chamber controller for Controlled Enviromental Random Testing (CERT).

As a controller, the SD410 may be used to select the test, initiate equalization, start and stop the test and select either fixed or continuous equalization during test time. As an environmental chamber interface, the SD410 puts the Chamber controller (customer supplied) in charge of the SD1200 system which insures that the environment is right before the specimen is vibrated.

7.2 INSTALLATION

The SD410 Remote Control unit mounts in a 19 inch rack and interconnects with the other SD1200 system components as shown in Figure 7-1.

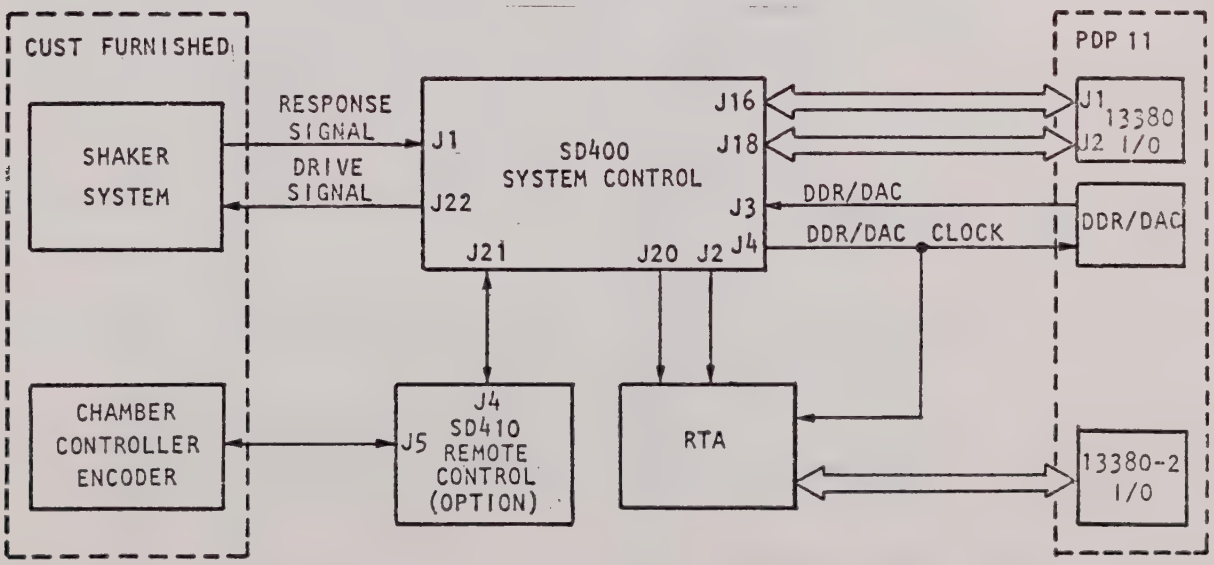


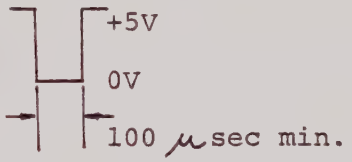
Figure 7-1 SD1200 System with SD410 Remote Control Option

When remote control of the SD1200 System is from an environmental chamber, the user must supply a chamber controller encoder. The following outline describes the required format for the signals between the Chamber Encoder and the SD410 Remote Control Unit. Figure 7-2 and Table 7-1 show the interconnections and pin assignments for the SD410 Remote Control Unit.

a. Chamber Encoder to SD410 Control Signals:

- Eight (8) data lines - AUX1 (LSB) through AUX 8 (MSB) are used to identify test number or other data. Signal levels are TTL (positive true) and transfer is parallel. Standard coding for the lines is BCD (00-99).

- Interval Strobe -



  Strobe is negative true and data lines are valid (read) during this period.

  This pulse is generated when the Chamber Encoder START button is pressed and when chamber conditions change to a new environmental condition. The control system reacts as follows:

  a. If the SD1200 is in the STOP state and the test hasn't been run before, the eight AUX lines are interpeted as a test number. The new test begins at the lowest pre-test level and equalizes at each level until it reaches the full test level.
  b. If the SD1200 is running a test and the ENTER button is pressed, the eight AUX lines are read and the new test profile is loaded from the disk into the computer memory. The current test level is reduced to it's lowest pre-test level. The system then switches to the new test profile and equalizes at each pre-test level.
  c. If the test was stopped with a manual or chamber STOP, the chamber strobe and eight AUX lines are read when ENTER is pressed. If the test number did not change, the system goes from STOP to full test without going through equalizations.

- Stop Line - A level, Neg true (OV to 0.8V). Used to stop the vibration control system. The system is restartable at full test level.
- Alarm Line - A level, Neg true (OV to 0.8V). Used to notify the vibration system of a problem in the chamber system. (Can be used for data logging). The system is not restartable to full test.

b. From SD410 to Chamber Encoder Control Signals:

- Hold - A level, Neg true (OV to 0.8V). Used to stop chamber timer until vibration control system is at full test level.
- Run - A level, Neg true (OV to 0.8V). Used to release hold condition and start chamber timer.
- Test In Progress - A TTL level (positive true) initiated 0.5 seconds before going to full level and held until the system exits from the full test condition.

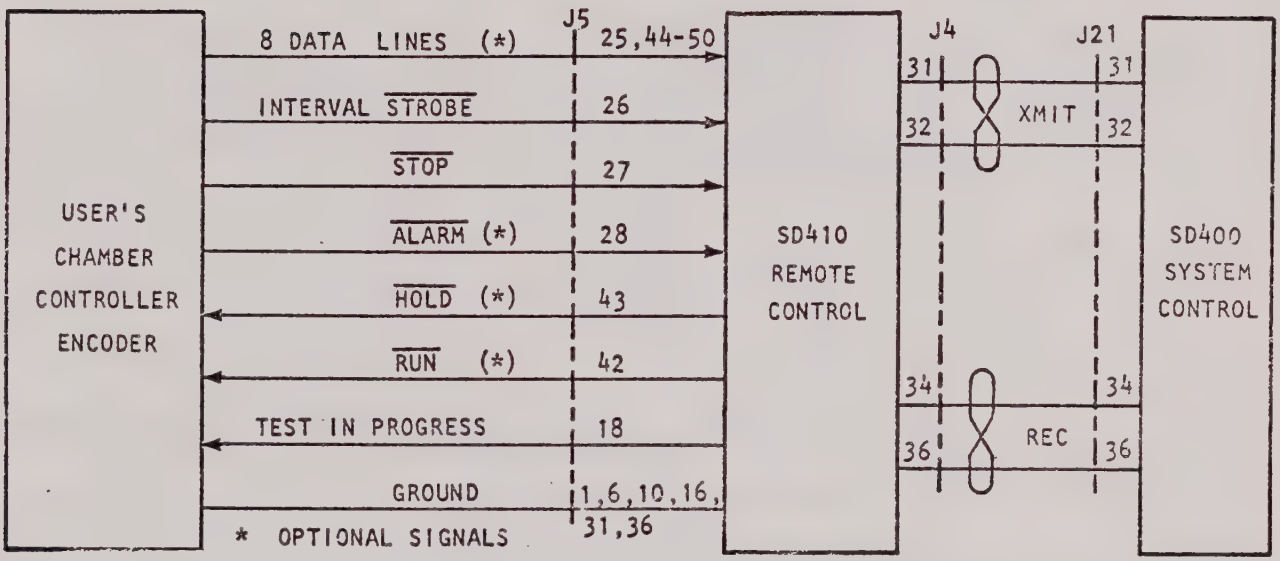


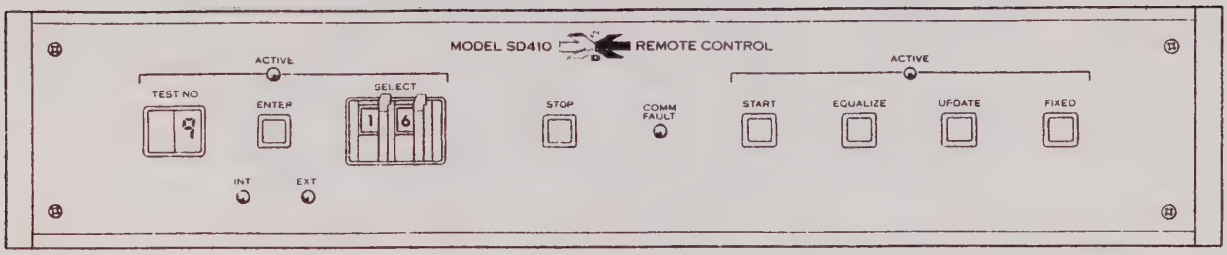
Figure 7-2 SD410 Remote Control and Chamber Controller Interconnections

TABLE 7-1 SD410 Pin Assignments for J5

PIN NO.	SIGNAL
1	GROUND
6	GROUND
11	GROUND
17	GROUND
18	TEST IN PROGRESS
25	AUX 8 (MOST SIGNIFICANT BIT)
26	STROBE
27	STOP
28	ALARM
31	GROUND
36	GROUND
42	RUN
43	HOLD
44	AUX 4
45	AUX 3
46	AUX 2
47	AUX 1 (least Significant Bit)
48	AUX 5
49	AUX 6
50	AUX 7

7.3 OPERATION

7.3.1 Front Panel Description



The SD1200 system can be controlled from the front panel of the SD410 Remote Control unit if the rear panel INT/EXT switch (S1) is in the INT position. When the INT/EXT switch (S1) is in the EXT position, only the STOP pushbutton is enabled. With the above in mind, the following paragraphs describe the functions performed by each front panel control and indicator.

ACTIVE LEDS - if the rear panel INT/EXT switch (S1) is in the INT (internal) position, the ACTIVE LEDS will illuminate when the SD410 is connected to the SD1200 system and the random program is loaded.

TEST NO - displays the current test number which is either selected from the SD400 or the SD410.

ENTER - an LED pushbutton which illuminates when pushed to enter a test number selected by the SD410. The SD400 REMOTE LED will illuminate when a test number is selected from the SD410.

SELECT - a two decade mini-lever switch which selects the desired test number. Selecting and entering number 00 will initilize the 410 and the TEST NO indicator will display the current SD400 test number.

STOP - an LED pushbutton which illuminates when pushed to stop a test. The stop Button is always active.

COMM FAULT - an LED that illuminates when a hardware error occurs. A master clear toggle (S2) on the rear panel usually clears this condition.

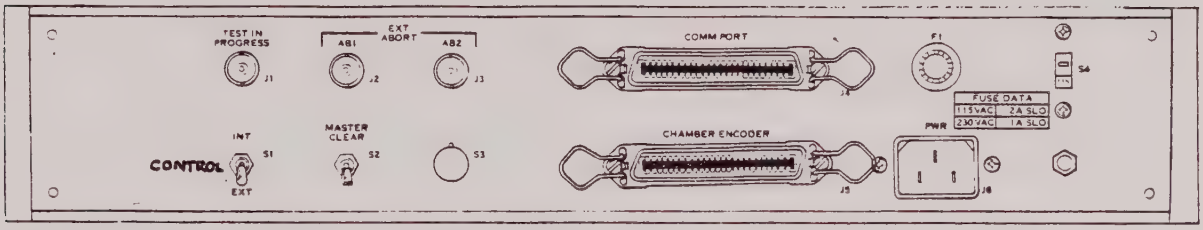
START - an LED pushbutton which illuminates when pushed to start a test.

EQUALIZE - if the SD400 System Control is in the MANUAL equalize mode, it will switch to the AUTO equalize mode when the EQUALIZE pushbutton is depressed. If the SD400 was already in the AUTO equalize mode, no change will take place. Pushing the EQUALIZE button while test is running will return the test to the highest pre-test level into the MANUAL mode.

UPDATE - an LED pushbutton which puts the SD400 in the UPDATE (closed loop) mode of operation.

FIXED - an LED pushbutton which puts the SD400 in the FIXED (open loop) mode of operation.

7.3.2 Rear Panel Description



TEST IN PROGRESS (J1) - a TTL level (positive true) mode available for customer use to light a light or energize a relay, etc. The signal is initiated 0.5 seconds before going to full test level and is held until the system exits from the full test condition.

EXT ABORT AB1 (J2) and AB2 (J3) - a relay closure (signal to ground) input used to stop the test. The SD400 stop code indicator will display code 6 or 7 for AB1 or AB2 respectively.

COMM PORT (J4) - transmit and receive twisted pairs used to communicate in serial form with the SD400 System Control.

CHAMBER ENCODER (J5) - used to transmit signals between the Chamber Encoder and the SD410 Remote Control Unit.

PWR (J6) - accepts 3-wire plug for applying 115/230 VAC, primary input power.

F1 (Fuseholder) - accepts a 3AG Slo-Blo fuse. The rating of F1 is 2 amps for 115 Vac and 1 amp for 230 Vac operation.

S4 (115/230 VAC Switch) - provides switching of primary input power circuits for either 115 Vac or 230 Vac operation. Proper input voltage to be applied is shown in switch window.

INT/EXT CONTROL (S1) - in the EXT (external) position, only the SD410 STOP pushbutton is enabled. All SD410 controls are enabled in the INT (internal) position and the front panel ACTIVE LEDS are ON.

MASTER CLEAR (S2) - used to reset the SD410 logic when a COMM FAULT occurs.

7.3.3 Operating Procedure

The SD410 controls the test by controlling the SD400 via twisted pairs or telephone MODEM from a remote location. The SD410 can also be used as an interface which allows a Chamber Encloder to select a test and control the SD400. When a Chamber Encoder is controlling the system, there is no operating procedure for the SD410. The following paragraphs describe how to operate an SD1200 system from the SD410 Remote Control Unit.

a. From the rear panel select INT (internal) contro with switch S1.

b. Connect the SD410 to the system as shown in Figure 7-1. The ACTIVE LEDS will illuminate when the random program is loaded.

c. Select the desired test number with the SELECT switches. A setting of 00 will cause the SD410 to select and display the current SD400 test number.

d. Press the ENTER pushbutton to enter that test. The test number will appear in the TEST NO. indicator.

e. Push the start button to begin the test.

f. Push the EQUALIZE button to assure that the SD400 is in the AUTO equalize mode. The SD400 will equalize at each pre-test level and automatically advance to the next highest pre-test level until it reaches the full test level.

g. Press either the UPDATE (closed loop operation) or FIXED (open loop operation) pushbutton to select the desired full test mode of operation.

h. If the front panel COMM FAULT LED lights (test will stop), toggle the rear panel MASTER CLEAR to reset the SD410 control logic.

APPENDIX A

APPENDIX A

RT-11 UTILITY PROGRAMS

This Appendix provides information on various utility programs that are part of the Digital Equipment Corporation (DEC) RT-11 Operating System. These programs will allow the user of a Spectral Dynamics SD1200 series system to transfer files between the system and certain peripheral devices; to create or extend files on certain file-structured devices; to compress, image copy, initialize or boot RT-11 file-structured devices; and to perform a wide range of directory listing operations.

This appendix includes excerpts from Digital Equipment Corporation's document Order No. DEC-11-ORITA-A-D, DN1, titled INTRODUCTION TO RT-11, dated March 1979. Devices described in this appendix may or may not be included in your system. Refer to your System Hardware Manual for the applicable equipment list. Programs included in this appendix are intended only to show software operating concepts.

A.1 INTRODUCTION

The SD1200 series system incorporates a DEC Model PDP-11 as dedicated processor, and the operating procedures outlined in Section III of this manual permit total system operation without special knowledge of the computer or the RT-11 Software System. The PDP-11, however, has the capabilities byond those required by the SD 1200. All of these capabilities are available for use independent of the SD1200, and may be implemented by a programmer who has access to the complete RT-11 software and supporting documentation. The purpose of this Appendix, however, is to impart enough information to a computer operator to allow the use of three utility programs that will increase the storage capacity and versatility of the SD1200 system.

A.2 THE COMMAND STRING INTERPRETER

The Command String Interpreter (CSI) is the part of the RT-11 system that accepts a line of ASCII input, usually from the console terminal, and interprets it as a string of input specifications, output specifications, and options for use by a system utility program.

Once you have started a system program, you must enter the appropriate information before any operation can be performed. You type a specification string in response to the prompting asterisk. The specifications are in the following general syntax:

```
output-filespecs/option=input-filespecs/option
```

The syntax for output-filespec is:

```
dev:filnam.typ [n], . . .dev:filnam.typ [n]
```

The syntax for input-filespec is:

```
dev:filnam.typ, . . .dev:filnam.typ
```

The syntax for /option is:

```
/o:pval or /o:dval.
```

Where

dev: represents either a logical device name or a physical device name, which is a 2- or 3- character name from Table A-1.

If you do not supply a device name, the system uses device DK:.DK:, or whatever device you specify for the first file in a list of input or output files, applies to all the files in that input or output list, until you supply a different device name. For example:

```
*DT1:FIRST.OBJ,LP:=TASK.1,RK1:TASK.2,TASK.3
```

This command is interpreted as follows:

```
*DT1:FIRST.OBJ,LP:=DK:TASK.1,RK1:TASK.2,RK1:TASK.3
```

File FIRST.OBJ is stored on device on device DT1:. File TASK.1 is stored on default device DK:. Files TASK.2 and TASK.3 are stored on device RK1:. Notice that file TASK.1 is on device DK:. It is the first file in the input file list and the system uses the default device DK:. Device DT1: applies only to the file on the output side of the command.

filnam.typ

represents the name of a file (consisting of one to six alphanumeric characters followed optionally by a dot and a zero to three character file type). No spaces or tabs are allowed in the file name or file type. As many as three output and six input files are allowed.

[n]

is an optional declaration of the number of blocks (n) you need for an output file; n is a decimal number (< 65,535) enclosed in square brackets immediately following the output filnam.typ to which it applies.

/o:oval or /o:dval.

represents one or more options whose functions vary according to the program you are using (refer to the option table in the appropriate chapter); oval is either an octal number or one to three alphanumeric characters (the first of which must be alphabetic) that the program converts to Radix-50 characters; dval. is a decimal number followed by a decimal point.

This manual uses the /o:oval construction throughout, except for the keyboard monitor commands, where all values are interpreted as decimal (unless indicated otherwise) and the decimal point after a value is not necessary. However, the /o:dval. format is always valid. Generally, these options and their associated values, if any, should follow the device and file name to which they apply.

If the same option is to be repeated several times with different values (e.g.,/L:MEB/L:TTM/L:CND) you can abbreviate the line as /L:MEB:TTM:CND. You can mix octal, Radix-50, and decimal values.

= If required, is a delimiter that separates the output and input fields. You can omit the separator entirely if there are no output files.

A.3 PERIPHERAL INTERCHANGE PROGRAM (PIP)

A.3.1 File Transfer and File Maintenance

PIP is file transfer and file maintenance utility program for RT-11. It may be used to transfer files between any of the RT-11 devices listed in Table A-1, and to merge, rename and delete files.

Table A-1 Permanent Device Names

Permanent Name	I/O Device
CR:	CR11/CM11 Card Reader
CTn:	TA11 Cassette (n is 0 or 1)
DK:	The default logical storage device for all files. DK: is initially the same as SY:
DKN:	The specified unit of the same device type as DK: if DK: is unassigned
DLn:	RL01 Disk (n is an integer in the range 0-3)
DMn:	RK06, RK07 Disk (n is an integer in the range 0-7)
DPn:	RP02, RP03 Disk (n is an integer in the range 0-7)

Table A-1 Permanent Device Names (Cont.)

Permanent Name	I/O Device
DSn:	RJS03/4 Fixed-Head Disks (n is an integer in the range 0-7)
DTn:	DECtape (n is an integer in the range 0-7)
DXn:	RX01 Diskette (n is an integer in the range 0-3)
DYn:	RX02 Diskette (n is an integer in the range 0-3)
EL:	Error Logging Handler
LP:	Line Printer
MMn:	TJU16/TU45 (industry compatible) Magtape (n is an integer in the range 0-7)
MTn:	TM11/TMA11/TS03/TE16 (industry compatible) Magtape (n is an integer in the range 0-7)
NL:	Null device
PC:	PC11 combined High-Speed Paper Tape Reader and Punch RF11 Fixed-Head Disk Drive
RKn:	RK05 Disk Cartridge Drive (n is an integer in the range 0-7)
SY:	The default logical system device; the device and unit from which the system is bootstrapped
SYn:	The specified unit of the same device type as SY: if SY: is unassigned
TT:	Console Terminal Keyboard and Printer

A.3.2 Calling and Using PIP

To call PIP from the system device, respond to the dot (.) printed by the keyboard monitor by typing:

```
R PIP (RET)
```

The Command String Interpreter prints an asterisk at the left margin of the terminal and waits for you to type a command string. If you type only a carriage return at this point, PIP prints its current version number and prompts you again for a command string. You can type CTRL/C to halt PIP and return control to the monitor when PIP is waiting for input from the console terminal. You must type two CTRL/C's to abort PIP at any other time. To restart PIP, type R PIP or REENTER followed by a carriage return in response to the monitor's dot. The Command String Interpreter describes the general syntax of the command line that PIP accepts. You can type as many as six input file names, but only one output file name is allowed. You can put command options at the end of the command string or type them after any file name in the string. Type any number of options in a command line, as long as only one operation (insertion, deletion, etc.) is represented. You can also combine copy and delete operations on one line. If you specify a command involving random access devices for which the output specification is the same as the input specification, PIP does not move any files. It can, however, change the creation dates on the files if you use /T, or it can rename the files if you use /R.

Since PIP performs file transfers for all RT-11 data formats (ASCII, object, and image), it does not assume file types for either input or output files. You must explicitly specify all file types, where file types are applicable.

On random access devices, such as disks and DECtape, PIP operations retain a file's creation date. If the file's creation date is 0, PIP gives it the current system date.

A.3.2.1 Wildcards

Some commands accept wildcards (% and *) in place of the file name, file type, or characters in the file name or file type. The system ignores the contents of the wild field and selects all the files that match the remaining fields.

An asterisk (*) can replace a file name:

```
*.MAC
```

The system selects all files on device DK: that have a .MAC file type, regardless of their name.

An asterisk (*) can replace a file type:

```
TEST.*
```

The system selects all files on device DK: that are named TEST, regardless of their file type.

An asterisk (*) can replace both a file name and a file type:

```
*.*
```

The system selects all files on device DK:.

An embedded asterisk (*) can replace any number of characters in the input file name or file type:

```
A*B.MAC
```

The system selects all files on device DK: with a file type of .MAC whose file names start with A and end with B. For example, AB, AXB, AYYB, etc. would be selected.

The percent symbol (%) is always considered an embedded wildcard. It can replace a single character in the input file name or file type.

```
A%B.MAC
```

The system selects all files on device DK: with a file type of .MAC whose file names are three characters long, start with A, and end with B. For example, AXB,AYB,AZB, etc. would be selected.

Table A-2 lists commands that support wildcards.

Table A-2 Commands Supporting Wildcards

Command	Accepts Wildcards in Input File Specification	Accepts Wildcards in Output File Specification
COPY	X	X
DELETE	X	
DIRECTORY	X	
HELP	X	
PRINT	X	
RENAME	X	X
TYPE	X	

For the command that support wildcards the system has a special way of interpreting the file specifications you type. You can omit certain parts of the input and output specifications, and the system assumes an asterisk (*) for the omitted item. Table A-3 shows the defaults that the system assumes for the input and output specifications of the valid commands.

Table A-3 Wildcard Defaults

Command	Input Default	Output Default
COPY,RENAME	*.*	*.*
DIRECTORY	DK:*.*	
PRINT,TYPE	*.LST	
DELETE	filnam.*	

For example, if you need to copy all the files called MYPROG from DK: to DX1:, use this command:

```
.COPY/NOQUERY MYPROG DX1:
```

The system interprets this command to mean:

```
.COPY/NOQUERY  DK:MYPROG.*  DX1:*.*
```

The system copies all the files called MYPROG, regardless of their file type, to device DX1: and gives them the same names.

If you need a directory listing of all the files on device DK:, type the following command:

```
.DIRECTORY
```

The system interprets this command to mean:

```
.DIRECTORY  DK:*.*
```

To list on the printer all the files on device DK: that have a .LST file type, use this command:

```
.PRINT  DK:
```

The system interprets this command to mean:

```
.PRINT  DK:*.LST
```

To delete all the files on device DK: called MYPROG, regardless of their file type, use this command:

```
.DELETE/NOQUERY  MYPROG
```

The system interprets this to mean:

```
.DELETE/NOQUERY  DK:MYPROG.*
```

A.3.2.2 Wildcard Usage

you can use all variations of the wildcard construction for the input file specifications in the PIP command line, but output file specifications cannot contain embedded wildcards. If you use any wild character in an input file specification, the corresponding output file name or file type must be an asterisk. The concatenate copy operation is an exception to this rule because it does not allow wildcards in

the output specification. These two lines are examples of wildcard usage:

```
**.B=A%B.MAC

*B.*=A%B.MAC
```

The first command string is legal. The second generates an error message because the file name field of the input specification contains a wildcard and the output specification is not*.

The following command, for example, deletes all files with the file type.BAK (regardless of their file names) from device DK:.

```
**.BAK/D
```

The next command renames all files with a .BAK file type (regardless of file names) so that these files now have a .TST file type (maintaining the same file names).

```
**.TST=*.BAK/R
```

A.3.2.3 Order of Operations

PIP performs operations on files in the order in which you specify them in the command string. However, if the specification contains a wildcard, PIP operates on the files in the order in which they appear in the device directory. PIP ignores system files with the file type .SYS unless you also use the /Y option. PIP prints the error message? PIP-W-NO.SYS ACTION if you omit the /Y option on a command that would operate on .SYS files.

PIP ignores all files with the file type .BAD unless you explicitly specify both the file name and file type in the command string. PIP does not print a warning message when it does not include .BAD files in an operation. Because of the way PIP handles .BAD files, you cannot use a wildcard (*.BAD) to perform any operation on them.

This example transfers all files, including system files, (regardless of file name or file type) from device DK: to device RK1:. It does not transfer .BAD files.

```
*RK1:*.*/Y=*.*
```

A.3.3 PIP Options

Certain options permit you to perform various operations with PIP.

Table A-4 summariezes the operations that PIP performs. If you do not specify an option, PIP assumes that the operation is a file transfer in image mode. The following sections are organized by function. Operations involving magtape and cassette are discussed first because these operations are treated uniquely by PIP. The other functions (copy, delete, rename, log, and query)are described next. Explanations of the options are arranged alphabetically in the discussions of the appropriate functions.

Table A-4 PIP Options

Option	Section	Explanation
/A	A.3.3.2.2	Copies files in ASCII mode, ignoring nulls and rubouts. It converts to 7-bit ASCII and treats CTRL/Z (32 octal) as the logical end-of-file on input (the default copy mode is image).
/B	A.3.3.2.3	Copies files in formatted binary mode (the default copy mode is image).
/C	A.3.3.2.4	Can be used with another option. It causes PIP to include only files with the current date in the specified operation.
/D	A.3.3.3	Deletes input files from a specific device. Note that PIP does not automatically query before it performs the operation. If you combine /D with a copy operation, PIP performs the delete operation after the copy completes. This option is illegal in an input specification with magtape.
/G	A.3.3.2.5	Ignores any input errors that occur during a file transfer and continues copying.
/K:n	A.3.3.2.6	Makes n copies of the output files to LP:,TT:, or PC:.
/N	A.3.3.2.7	Does not copy or rename a file if a file with the same name exists on the output device. This option protects you from accidentally deleting a file. This option is illegal for magtape and cassette in the output specification.
/O	A.3.3.2.8	Deletes a file on the output device if you copy a file with the same name to that devive. The delete operation occures before the copy operation. This option is illegal for magtape and cassette in the output specification.
/P	A.3.3.2.9	Copies or deletes all files except those you specify.

Table A-4 PIP Options (Cont.)

Option	Section	Explanation
/Q	A.3.3.6	Use only with another operation. The /Q option causes PIP to print the name of each file to be included in the operation you specify. You must respond with a Y to include a particular file.
/R	A.3.3.4	Renames the file you specify. This operation is illegal for magtape and cassette.
/S	A.3.3.2.10	Copies files one block at a time.
/T	A.3.3.2.11	Puts the current date on all files you copy or rename, unless the current date is 0. This option is illegal for magtape and cassette; operations involving those devices always use the current date.
/U	A.3.3.2.12	Copies and concatenates all files you specify.
/W	A.3.3.5	Prints on the terminal a log of copy, rename, and delete operations.
/Y	A.3.3.2.13	Includes .SYS files in the operation you specify. You cannot modify or delete these files unless you use the /Y option.

A.3.3.1 Copy Operations

The following sections describe the types of copy operation that PIP can perform. PIP copies files in image, ASCII, and binary format. Other options let you change the date on the files, access .SYS files, combine files, and perform other similar operations. PIP automatically allocates the correct amount of space for new files in copy operations (except for concatenation). For block-replaceable devices, PIP stores the new files in the first empty space large enough to accommodate it. If an error occurs during a copy operation, PIP prints a warning message, stops the copy operation, and prompts you for another command. You cannot copy .BAD files unless you specifically type each file name and file type.

A.3.3.1.1 Image Mode

If you enter a command line without an option, PIP copies files onto the destination device in image mode. Note that you cannot reliably transfer memory image files to or from paper tape, or to the line printer or console terminal. PIP can image-copy ASCII and binary data but it does not do any of the data checking described in Sections A.3.3.2.2 or A.3.3.2.3.

The following command makes a copy of the file named XYZ.SAV on device DK: and assigns it the name ABC.SAV. (Both files exist on device DK: following the operation).

```
*ABC.SAV=XYZ.SAV
```

The next example copies from DK: all .MAC files whose names are three characters long and begin with A. PIP stores the resulting files on DX1:.

```
*DX1:*.*=A%%.MAC
```

A.3.3.1.2 ASCII Mode (/A)

Use the /A option to copy files in 7-bit ASCII mode. PIP ignores nulls and rubouts in an ASCII mode file transfer. PIP treats CTRL/Z (32 octal) as logical end-of-file if it encounters that character in the input file. The following command copies F2.FOR from device DK: onto device DT1: in ASCII mode and assigns it the name F1.FOR.

```
*DT1:F1.FOR=F2.FOR/A
```

A.3.3.1.3 Binary Mode (/B)

Use the /B option to transfer formatted binary files (such as .OBJ files produced by the assembler or the FORTRAN compiler and .LDA files produced by the linker). The following command, for example, transfers a formatted binary file from the paper-tape reader to device DK: and assigns it the name FILE.OBJ.

```
*DK:FILE.OBJ=PC:/B
```

When performing formatted binary transfers, PIP verifies checksums and prints a warning if a checksum error occurs. If there is a checksum error and you did not use/G to ignore the error, PIP does not perform the copy operation. You cannot copy library files with the /B option; PIP prints the ?PIP-F-LIBRARY FILE NOT COPIED message. Copy them in image mode.

A.3.3.1.4 The Newfiles Option (/C)

Use the /C option in the command line if you want to copy only those files with the current date. Specify /C only once in the command line. It applies to all the file specifications in the entire command. The following command copies (in ASCII mode) all files named ITEM1.MAC

that also have the current date. It also copies the file ITEM2.MAC, if it has the current date, from DK: to DT2:. It combines all these files under the name NN3.MAC.

```
*DT2:NN3.MAC=ITEM1.MAC*/C,ITEM2.MAC/A/U
```

The next command copies all files with the current date (except .SYS and .BAD files) from DK: to DX1:. This is an example of an efficient way to back up all new files after a session at the computer.

```
*DX1:*.*=*.*/C
```

A.3.3.1.5 The Ignore Errors Option (/G)

Use the /G option to copy files, but ignore all input errors. This option forces a single-block transfer, which you can invoke at any other time with the /S option. Use the /G option if an input error occurred when you tried to perform a normal copy operation. The procedure can sometimes recover a file that is otherwise unreadable. If an error still occurs, PIP prints the ?PIP-W-INPUT ERROR message and continues the copy operation. The following command, for example, copies the file TOP.SAV in image mode from device DT1: to device DK: and assigns it the name ABC.SAV.

```
*ABC.SAV=DT1:TOP.SAV/G
```

The next command copies files F1.MAC and F2.MAC in ASCII mode from device DT1: to device DT2:. This command creates one file with the name COMB.MAC, and ignores any errors that occur during the operation.

```
*DT2:COMB.MAC=DT1:F1.MAC.F2.MAC/A/G/U
```

A.3.3.1.6 The Copies Option (/K:n)

The /K:n option directs PIP to generate n copies of the file you specify. The only legal output devices are the console terminal, the line printer, and paper-tape punch. Normally, each copy of the file begins at the top of a page; copies are separated by form feeds.

```
*LP:=FOO.LST/K:3
```

This command, for example, prints three copies of the listing file, FOO.LST, on the line printer.

A.3.3.1.7 Noreplace Option (/N)

The /N option prevents execution of a copy of rename operation if a file with the same name as the output file already exists on the output device. This option is valid for magtape and cassette files for input but not for output. The following example uses the /N option.

```
*DX0:CT.SYS=DK:CT.SYS/Y/N
?PIP-W-Output file found, no operation performed DK:CT.
SYS*
```

The file named CT.SYS already exists on DXO:, and the copy operation does not proceed.

A.3.3.1.8 The Predelete Option (/O)

The /O option deletes a file on the output device if you copy a file with the same name to that device. PIP deletes the file on the output device before the copy operation occurs. Normally, PIP deletes a file of the same name after the copy completes. This option is valid for magtape and cassette files for input but not for output. The following example uses the /O option.

```
*RK1:TEST1.MAC=DT2:TEST.MAC/0
```

If a file named TEST1.MAC already exists on RK1:, PIP deletes it before copying TEST.MAC from DT2: to TEST1.MAC on RK1:.

A.3.3.1.9 The Exclude Option (/P)

The /P option directs PIP to transfer all files except the ones you specify.

```
*DTO:*.*=DX1:*.MAC/P
```

This command, for example, directs PIP to transfer all files from DX1: to DTO: except the .MAC files.

A.3.3.1.10 The Single-block Transfer Option (/S)

The /S option directs PIP to copy files one block at a time. On some devices, this operation increases the chances of an error-free transfer. You can combine the /S option with other PIP copy options. For example:

```
*RK1:TEST.MAC=RK0:TEST.MAC/S
```

PIP performs this transfer one block at a time.

A.3.3.1.11 The Setdate Option (/T)

This option causes PIP to put the current date on all files it transfers, unless the current date is 0. Normally, PIP preserves the existing file creation date on copy and rename operations. This option is invalid for operations involving magtape and cassette because PIP always uses the current date for tape files. The following command puts the current date on all the files stored on device DK:.

```
**.*=*.*/Y/T
```

Note that the command shown above changes only the dates; PIP does not move or change the files in any other way.

A.3.3.1.12 The Concatenate Option (/U)

To combine more than one file into a single file, use the /U option. This option is particularly useful to combine several object modules into a single file for use by the linker or librarian. PIP does not accept wildcards on the output specification. The following examples use the /U option.

```
*DK:AA.OBJ=DT1:BB.OBJ,CC.OBJ,DD.OBJ/U
```

The command shown above transfers files BB.OBJ, CC.OBJ and DD.OBJ to device DK: as one file and assigns this file the name AA.OBJ.

```
*DT3:MERGE.MAC=DT2:FILE2.MAC,FILES3.MAC/A/U
```

This command merges ASCII files FILE2.MAC and FILES3.MAC on DT2: into one ASCII file named MERGE.MAC on device DT3:.

A.3.3.1.13 The System Files Option (/Y)

Use the /Y option if you need to perform an operation on system files (.SYS). For example:

```
**.*=DT3:*.*/G/Y
```

This command copies to device DK:, in image mode, all files (includ-

ing .SYS files) from device DT3:. Because of the /G option, PIP ignores any input errors.

A.3.3.2 The Delete Operation (/D)

Use the /D option to delete one or more files from the device you specify. Note that PIP does not automatically query you before it performs the operation; you must use/Q. Remember to use the /Y option to delete .SYS files. You cannot delete .BAD files unless you name each one specifically, including file name and file type. You can specify only six files in a delete operation unless you use wildcards. You must always indicate a file specification in the command line. A delete command consisting only of a device name (dev:/D) is invalid. The delete option is also illegal for magtape. The follwoing examples illustrate the delete operation.

```
*FILE1.SAV/D
```

The command shown above deletes FILE1.SAV from device DK:.

```
*DX1:*.*/D
?PIP-W-No .SYS action
*
```

The command shown above deletes all files from device DX1: except those with a .SYS or .BAD file type. If there is a file with a .SYS file type, PIP prints a warning message to remind you that this file has not been deleted.

```
**.MAC/D
```

This command deletes all files with a .MAC file type from device DK:.

A.3.3.3. The Rename Operation (/R)

Use the /R option to rename a file you specify as input, giving it the name you specify in the output specification. You must supply an equal number of input and output files that reside on the same device. PIP prints an error message if the command specifications are not valid. Use the /Y option with /R if you rename .SYS files. You cannot use /R with magtape or cassette.

The rename command is particularly useful when a file on disk or DECtape contains bad blocks. By renaming the file, giving it a .BAD file type, you can ensure that the file permanently resides in that area of the device. Thus, the system makes no other attempts to use the bad area. Once you give a file a .BAD file type, you cannot move it during a compress operation. You cannot rename .BAD files unless

you specifically indicate both the file name and file type. The following examples illustrate the rename operation.

```
*DT1:F1.MAC=DT1:FO.MAC/R
```

The command shown above renames FO.MAC to F1.MAC on device DT1:.

```
*DX1:OUT.SYS=DX1:CT.SYS/Y/R
```

This command renames file CT.SYS to OUT.SYS.

A.3.3.4 The Logging Operation (/W)

When you use the /W option, PIP prints a list of all files copied, renamed, or deleted. The /W option is useful if you do not want to take the time to use the query mode (the /Q option, described in Section A.3.3.6), but you do want a list of the files operated on by PIP.

PIP prints the log for an operation on the terminal beneath the command line. This example shows logging with the delete operation.

```
*DX1:*.*/D/W
?PIP-W-No .SYS action
Files deleted:
DX1:TEST.MAC
DX1:FIX463.SAV
DX1:GRAPH.BAK
DX1:DMPX.MAC
DX1:MATCH.BAS
DX1:EXAMP.FOR
DX1:GRAPH.FOR
DX1:GLOBAL.MAC
DX1:PROSEC.MAC
DX1:KB.MAC
DX1:EXAMP.MAC
*
```

A.3.3.5 The Query Option (/Q)

Use the /Q option with another PIP operation to list all files and to confirm individually which of these files should be processed. Typing a Y (or any string that begins with Y) followed by a carriage return causes the named file to be processed; typing anything else excludes the file. The follwoing example deletes files from DX1:.

```
*DX1:*.*/D/Q
Files deleted:
DX1:FIX463.SAV?
```

```
DX1:GRAPH.BAK ? Y
DX1:DMPX.MAC  ?
DX1:MATCH.BAS ?
DX1:EXAMP.FOR ?
DX1:GRAPH.FOR ? Y
DX1:GLOBAL.MAC? Y
DX1:PROSEC.MAC? Y
DX1:KB.MAC    ?
DX1:EXAMP.MAC ?
*
```

A.4 Device Utility Program (DUP)

Dup is a device utility program for use with the RT-11 system and file-structured RT-11 devices. DUP creates files on disks, DECtape, magtape and cassette. It can also extend files on disk and DECtape. Finally, it can compress, image copy, initialize, or boot RT-11 file-structured devices. Dup does not operate on non-file-structured devices such as line printers, card readers, terminals or paper tape.

A.4.1 Calling and Using Dup

To call DUP from the System device, respond to the dot (.) printed by the keyboard monitor by typing:

```
R DUP (RET)
```

The Command String Interpreter prints an asterisk (*) at the left margin of the terminal and waits for a command string. If you enter only a carriage return in response to the asterisk, DUP prints its current version number. You can type CTRL/C to halt DUP and return control to the monitor when DUP is waiting for input from the console terminal. You must type two CTRL/C's to abort DUP at any other time. The /S, /T, and /C operations, however, lock out the CTRL/C command until the operation completes; these three operations cannot be interrupted with CTRL/C. To restart DUP, type R DUP or REENTER in response to the monitor's dot. Section A.2, Command String Interpreter, describes the general syntax of the command line that DUP accepts. DUP accepts only one input file specification and one output file specification in the command line.

A.4.2 DUP OPTIONS

Certain options are available for use with DUP. These options are divided into two categories: 1) Action and 2) Mode. Action options cause specific operations to occur. You can use these options alone or with valid mode options. Usually, you can specify only one action option at a time. Mode options modify action options. Table A.5 illustrates which mode options you can use with a particular action option.

Table A-5. DUP Options and Categories

Action	Mode
C	W,Y
I	W,Y
K	W,F,H
O	W,Y
S	W,X,Y
T	W,Y
U	W
V	W
Z	W,B,N,R,V,Y

Note that /V can be either an action or a mode option, depending on how you use it.

You can use DUP action options to create files, copy devices, scan for bad blocks, perform a bootstrap operation, and so on. You can use the DUP mode options to modify the action options, where necessary. The following sections describe the various DUP options and give examples of typical uses. Table A-6 summarizes the options you can use with DUP.

Table A-6 DUP Options

Option	Section	Explanation
/B	A.4.2.11.4	Use with /Z to write files with the file type .BAD over any bad blocks DUP finds on the disk to be initialized
/C:m[:n]	A.4.2.1	Creates a file on the device you specify; m represents the starting block number (in octal) and n represents the size of the file in blocks.
/F	A.4.2.3	Use with the /K option to output the file name containing the bad block together with the relative block number of the bad block in the file.
/H	A.4.2.3	Use with the /K option to read the bad block, write to the bad block, and then read it again. This operation does not destroy information already stored on the device.

Table A-6 DUP Options (Cont.)

Option	Section	Explanation
/I[:rstart :rstop :wstart]	A.4.2.2	Copies the image of a disk to another disk or magtape or from magtape to disk. The arguments :rstart, :rstop, and :wstart represent block numbers.
/K[:start [:stop]]	A.4.2.3	Scans a device for bad blocks and outputs the octal address of the logical bad blocks to the output device. The arguments :start and :stop represent block numbers.
/N:n	A.4.2.11.1	Use with /Z to set the number of directory segments you require if you do not want the default size; n is an integer in the range 1-37 (octal).
/O	A.4.2.4	Boots the device or file you specify.
/R[:RET]	A.4.2.11.3	Use with /Z to scan the RK06 device for bad blocks and to create a replacement table on the disk for any bad blocks DUP finds. If you use :RET, DUP retains the replacement table that is already on the disk and does not pre-scan the disk for bad blocks.
/S	A.4.2.5	Compresses a disk (or DECtape) onto itself or onto another disk (or DECtape); the output device, if any, must be initialized.
/T:n	A.4.2.6	Extends an existing file by the number of blocks you indicate by :n.
/U	A.4.2.7	Writes the bootstrap portion of the monitor file in blocks 0 and 2-5 of the target device.
/V[:VOL]	A.4.2.8, A.4.2.11.2	Prints the user ID and owner name. Use it with /Z (as a mode option) to insert a user ID and owner name in block 1 of the initialized disk, or in the VOL1 header block on magtape (not applicable for cassette). Using /V:VOL as an action option causes only the ID and owner name to be changed, and does not initialize the device (not applicable for cassette).

Table A-6 DUP Options (Cont.)

Option	Section	Explanation
/W	A.4.2.9	Use with any action option (but only one) to initiate an operation and then pause. This is useful on small, single-disk systems because it lets you replace the system device with another disk before performing an operation.
/X	A.4.2.5	Use with /S to inhibit automatic booting of the system device when it is compressed.
/Y	A.4.2.10	Use with /C, /I, /O, /S, /T, or /Z to inhibit the dev:/xxxx ARE YOU SURE? message and the FOREGROUND JOB LOADED, CONTINUE? message and ensure immediate execution of the operation.
/Z :n	A.4.2.11	Initializes the directory of the device you specify. The size of the directory defaults to the standard RT-11 size; use :n to allocate extra directory words for each entry beyond the default.

A.4.2.1 The Create Option (/C:m [:n])

The /C option creates a file with a specific name, location, and size on the block-replaceable device that you specify. This command is useful to recover files that have been deleted. The /C option only creates a directory entry for the file. It does not store any data in the file. You must specify both the file name and file type of the file to be created. The syntax of the command is:

```
filespec=/C:m [:n]
```

Where

filespec — represents the device, file name and file type of the file to be created.

:m — represents the numeric value, in octal, of the starting block of the file to be created.

:n — represents the size of the file in blocks. If you do not supply a value for n, DUP creates a 1-block file.

You can use the /C option to cover bad blocks on a disk by creating a file with a file type .BAD to cover the bad area.

Use /C also to recover accidentally-deleted files. In this case, use DIR to obtain a listing of the device. Use the /E and the /Q options in DIR; obtain a separate listing with each one. DIR lists files, tentative files, empty areas, and the sizes of all areas. You can then assign a file name to the area that contains the data you lost.

You can also use DUP to set aside a file on disk without performing any input or output operations on the file.

When you use the /C option, make sure that the area in which the file is to be created is empty. If there are more blocks in the empty than the file you are creating needs, DUP attempts to put the extra blocks in empties that are contiguous to the file you are creating. If there is not enough room in contiguous empties, the error message ?DUP-F-ILLEGAL CONTIGUOUS FILE prints and DUP does not create the file. The /C option checks for duplicate file names. If the file name you specify already exists on the device, DUP issues an error message and does not create a second file with the same name.

This is an example of a command that uses /C:

```
*DK1:FILE.MAC=/C:140:3
```

This command creates a file named FILE.MAC consisting of blocks 140, 141, and 142 on device DK1:.

A.4.2.2 The Image Copy Option (/I)

The /I option copies block for block from one device to another. (This operation is not applicable for magtape or cassette). If DUP encounters a bad block, it prints an error message. However, it retries the operation and performs the copy one block at a time. If only one error message prints, you can assume that the transfer completed correctly. The /I option is often used to copy one disk to another without changing the file structure or location of files on the device. In this case, it is an added convenience that you do not have to copy a boot block to the device. You can also copy disks that are not in RT-11 format, if they have no bad blocks.

Qualifiers to the /I option let you specify the blocks to be read from the input device; you can also specify a starting block number

on the output device for the write operation. The syntax of the command is:

```
output-device:[A]=input-device:/I[:rstart:rstop:wstart]
```

where

A	represents a dummy file name, required if the output device is a directory-structured device.
:rstart	represents the starting block number on the input device for the read operation.
:rstop	represents the ending block number on the input device for the read operation.
:wstart	represents the starting block number on the output device for the write operation.

The command string must include an input and an output specification; there is no default device. If you need to specify a block number, you must supply all three block values. The /I operation does not copy to or from a device that has logical bad blocks. (Physical bad blocks can be logically replaced or covered, as Section 8.2.11.3 and 8.2.11.4 describe). If one device is smaller than the other, DUP copies only the number of blocks of the smaller device.

You can copy blocks between disk and magtape with /I. DUP stores the data on the tape, formatting it in 1K word blocks. It is possible to store only one disk image on a magtape, regardless of the size of the tape.

The following examples use the /I option. The file name A is not significant; it is a dummy file name required by the Command String Interpreter.

```
*RK1:A=RK0:/I

RK1:/Copy are you sure?
```

The command shown above copies all blocks from DK: to RK1:.

```
*RK1:A=RK0:/I:0:500:501

RK1:/Copy are you sure?Y
```

This command copies blocks 0-500 from RK0: to RK1:, starting at block 501.

A.4.2.3 The Bad Block Scan Option (/K)

Sometimes devices (disks and DECtapes) are manufactured with bad blocks, or they develop bad blocks as a result of use and age. You can use the /K option to scan a device and locate bad blocks on it. DUP prints the absolute block number of those blocks on the device that return hardware errors when DUP tries to read them. If you specify an output device (only TT: and LP: are valid), DUP prints the bad block report on that device. Remember that block numbers are octal and the first block on a device is block 0. If DUP finds no bad blocks, it prints only the header. A complete scan of a disk pack takes from one to several minutes depending on the size of the device. It does not destroy data that is stored on the device.

DUP reads only one block at a time when it scans a disk for bad blocks. Errors can occur on a multi-block copy even if DUP does not detect any with /K. Copy the data to a scratch disk with the /I option to discover any other bad blocks. You should scan a device for bad blocks before using /S to compress the device; if a read error occurs during a compress operation, the device may become unuseable.

You can scan selected portions of a device by specifying a beginning and ending block number. The syntax of this command is:

```
[output-device:=]input-device:/K[:start[:stop]]
```

where

:start	represents the block number of the first block to be scanned.
:stop	represents the block number of the last block to be scanned.

If you specify only a starting block number, DUP scans from the block you specify to the end of the device. You cannot specify an ending block number unless you also specify a starting block number.

If the device to be scanned has files on it, you can use /F with the /K option to print the name of the file containing the bad block together with the relative block number within the file that is bad.

You can use /H with /K to read the bad block, write to the bad block, and then read it again. If the block is still bad, DUP reports a HARD error. If the block recovers, DUP reports a SOFT error. This procedure does not destroy data already stored on the device.

The following command line uses the /K option to scan the entire disk, RK1:.

```
*RK1:/K/F
BAD BLOCKS FILENAME          REL BLK TYPE
  6615     EMPTY1.TST          6547   HARD
  6645     EMPTY2.TST          6577   HARD
  7255     EMPTY3.TST          7207   HARD
```

A.4.2.4 The Boot Option (/O)

The /O option can perform two operations: 1) a hardware bootstrap of a specific device and 2) a bootstrap of a particular monitor file that does not affect the bootstrap blocks on the device. The command syntax for a device bootstrap is as follows:

```
dev:/O
```

This operation has the same results as a hardware bootstrap. Legal devices for the boot operation are DT0:, RK0:-RK7:,RF:,SY:,DK:,DP0:-DP7:,DX0:-DX1:,DM0:-DM7:, and DS0:-DS7:.

Use the following syntax to boot the monitor you specify without changi the bootstrap on the device.

```
dev:monitor-name/O
```

This makes it easy for you to switch from one monitor to another. Whether bootstrapping a specific monitor or a specific device, DUP checks to see if the bootstrap blocks are correctly formatted. If the boot operation you request is invalid for any reason, DUP prints an error message and waits for anothe command.

When you reboot with the /O option, you do not have to reenter the data and time of day with the monitor DATE and TIME commands. However, the clock does lose a few seconds during the reboot.

The following command reboots the RT-11 system under the single-job monitor:

```
*RK0:RKMNSJ.SYS/O

RT-11SJ    V03.01
```

Notice in this command that the device you specify must be the same device type as the first two characters of the monitor file indicate. Because of this restriction on the monitor-name bootstrap operation, the following command is illegal:

```
*RK0:DXMNFB.SYS/O
```

However, the next command is a valid one:

```
*RK0:RKMNFB.SYS/O
```

A.4.2.5 The Squeeze Option (/S)

Use the /S option to compress a device (disk or DECtape) onto itself or onto another disk or DECtape. To do this, DUP moves all the files to the beginning of the device, producing a single, unused area after the group of files. The squeeze operation does not change the bootstrap blocks of a device. The output device you specify, if any, must be an initialized device. If you specify an output device, DUP does not query you for confirmation before it performs the operation. If you do not specify an output device, DUP prints the ARE YOU SURE? message and waits for your response before proceeding. You must type Y followed by a carriage return to execute the command. Since it is critical to perform an error-free squeeze operation, be sure to scan a device (with /K) before you use /S.

The /S option does not move files with .BAD file types. This feature prevents you from reusing bad blocks that occur on a disk. You can rename files containing bad blocks, giving them a .BAD file type, and DUP then leaves them in place when you execute a /S. DUP inserts files before and after .BAD files until the space between the last file it moved and the .BAD file is smaller than the next file to be moved. If an error occurs during a squeeze operation, DUP continues the operation, performing it one block at a time. If only one error message prints, you can assume that the operation completed correctly.

The syntax of the command is:

```
[output-device=]input-device/S
```

Do not use /S on the system device (SY:) when a foreground job is loade
A ?DUP-F-CANNOT WRITE SY:WHILE FJOB LOADED error message results if you attempt this and DUP ignores the /S operation. You must unload the foreground job before using the /S option.

NOTE

If you perform a compress operation on the system device, the system automatically reboots when the compress operation is completed. This operation takes place in order to prevent system crashes that can occur when the monitor file is moved.

You can use /X with /S to suppress the automatic reboot and leave DUP running. However, you should use /X only if you are certain that the monitor file will not move. Even then, you should reboot the system when the squeeze operation completes if the device handlers have moved. If you specify the /X option but for some reason the USR cannot be made resident, DUP reboots the system anyway. If you use /X and the system is not rebooted, the ?DUP-W-REBOOT message prints. This is a warning message; it is for your information only.

The follwoing examples use the /S command:

```
*SY:/S

 SY:/Squeeze are you sure?Y

RT-11SJ    V03.01
```

The command shown above compresses the files on the system device and reboots the system when the compress operation completes.

```
*DT1:A=DT2:/S
```

This command transfers all the files from device DT2: to device DT1:, leaving DT2: unchanged. The file name A is not significant; it is a dummy file name required by the Command String Interpreter.

A.4.2.6 The Extend Option (/T:n)

Use the /T option to extend the size of a file. The syntax of the command is:

```
filespec/T:n
```

where

filespec	represents the device, file name, and file type of the file to be extended.
n	represnets the number of blocks to add to the file.

You can extend a file in this manner only if it is followed by an unused area at least n blocks long. Any blocks not required by the operation remain in the unused area.

The following example uses the /T option:

```
*DT1:ZYZ.TST/T:100
```

This command assigns 100 more blocks to the file named ZYZ.TST on device DT1:.

A.4.2.7 The Bootstrap Copy Option (/U)

In order to use a disk as a system device, you must copy a bootstrap onto the disk. To do this, first make sure that the appropriate monitor file is stored on the disk. For a diskette system, for example, you could use the foreground/background monitor file called DXMNFB.SYS. If you copy the monitor file onto the diskette from another device, be careful not to rename it. DUP recognizes only standard RT-11 monitor file names in the bootstrap copy operation. Use the /U option to copy the bootstrap portion of the monitor file into absolute blocks 0 and 2-5 of the device. You can then use the /O option to boot the device.

To copy a bootstrap for the single-job monitor on RK1:, for example, use the following procedure:

1. Obtain a formatted disk. (Most disks and DECtapes are formatted by the manufacturer. However, Appendix C does outline the procedure for reformatting RK05 disks and RX02 diskettes).
2. Initialize the disk with /Z.
3. Copy files onto the disk.

4. Copy the monitor onto the disk.

5. Copy the monitor bootstrap onto the disk with /U.

The following example shows how to initialize a diskette, copy files to it, and write a bootstrap onto the diskette:

```
*DX1:/Z/Y
```

The command shown above (step 2 of the procedure described above) initializes the diskette.

```
*DX1:A=DX0:/S
```

This command, which combines steps 3 and 4, squeezes all the files from DX0: onto DX1:.

```
*DX1:A=DX1:DXMNFB.SYS/U
```

The last command (step 5) writes the bootstrap for the diskette foreground/background monitor onto the bootstrap blocks (blocks 0 and 2-5) of DX1:. The file name A is not significant; it is a dummy file name requred by the Command String Interpreter.

A.4.2.8 The Volume ID Option (/V[:VOL])

You can use the /V option as an action option to print the volume ID of a device or to change the volume ID without initializing the device. The syntax of the command is:

```
device:/V[:VOL]
```

where

device: is the device whose volume ID you want to display or change.

If you specify only /V, the volume ID and owner name of the device you specify print out on the console terminal. If you specify /V:VOL,DUP assumes you need to change the volume ID and owner name. DUP prompts you for a volume ID:

```
VOL  ID?
```

Respond with a volume ID that is up to 12 characters long for a block-replaceable device, or up to 6 characters long for magtape. Terminate your respond with a carriage return. DUP then prompts for an owner name:

```
OWNER NAME?
```

Respond with an owner name that is up to 12 characters long for a block-replaceable device, or up to 10 characters long for magtape. Terminate you response with a carriage return. DUP ignores characters you type beyond the legal length. The /V:VOL command changes only the volume ID and owner name; it does not initialize the device. Section 8.2.11.2 describes how to use /V with the /Z option to initialize a device and write volume identification on it.

DUP stores the volume ID and owner name information in block 1 of a disk. The volume ID is stored in words 236-241 (decimal), the owner name is stored in words 242-247, and the format type, which is always DECRT11A followed by four spaces, is stored in words 248-253. The remainder of block 1 (words 0-235 and 254-255) is reserved for the system to use. If you are initializing a magnetic tape, DUP stores the volume identification information in the VOL1 header block of the mag-tape. The volume ID is stored in bytes 5-10 and the owner name is stored in bytes 41-50. The first byte of the header block is byte1; DUP stores VOL1 information up to byte 80.

The following example uses the /V:VOL option:

```
*RK1:/V:VOL/Y

VOL  ID?  VOUCHERS

OWNER NAME?  PAYABLES
```

This command writes a new volume ID and owner name on device RK1:.

A.4.2.9 The Small, Single-disk System Option (/W)

The /W option is useful for small (8K), single-disk systems. It is a mode option that you can use with any of the action options. However, you can perform only one operation at a time. The /W option initiates execution of a command, but then pauses and prints the message CONTINUE?. At this time you can remove the system disk and mount the disk on which you actually want the operation to take place. When the new disk is loaded, type a Y followed by a carriage return to execute the operation. When the operation completes (except the /O operation, which boots the system), the "CONTINUE?" message again prints.

Replace the system device and type a Y followed by a carriage return. The asterisk (*) prompt prints and DUP waits for you to enter another command. The following example uses the /W option:

```
*DX1:/K/F/W
CONTINUE?Y
?DUP-I-No bad blocks detected
?DUP-I-Insert DUP-resident disk, continue?Y
*
```

This command directs DUP to scan the disk for bad blocks. During the first pause, the system disk is removed and another disk is mounted. A Y is typed and the scan operation executes. During the second pause, the system disk (on which DUP is stored) is replaced and another Y is typed. DUP prompts for another command.

NOTE

Because DUP is an overlaid program, it is always necessary to use the /W option to change disks.

There is one exception to the general usage of /W. You cannot use the /U option to write a bootstrap on another disk if you have a single-disk system with only 8K words of memory. Follow this procedure to write a bootstrap on another disk:

1. Make the USR resident:

   ```
   .SET USR NOSWAP
   ```

2. Call the MDUP program (a program similar to DUP, but smaller)

   ```
   .R MDUP
   *
   ```

3. Change disks when MDUP prompts with an asterisk (*), as shown in step 2.

The new disk must already have the monitor file stored on it. Then enter the /U command to copy the bootstrap, as this example shows:

```
*RK0:A=RK0:RKMNSJ.SYS/U
```

When MDUP prints another asterisk, replace the system disk and type CTRL/C to return to the monitor.

A.4.2.10 The Noquery Option (/Y)

Use the /Y option to suppress the query messages that some commands print. The following options normally print the FOREGROUND JOB LOADED, CONTINUE? message if a foreground job is loaded when you issue one of these DUP commands:/C,/I,/O,/S,/T, and /Z. You must respond to the query message by typing Y followed by a carriage return for the operation to proceed. Some other options (/C,/I,/O,/S,/V, and /Z) print the ARE YOU SURE? message and wait for your response. If a foreground job is loaded and you specify one of these options, DUP combines the two query messages into one message and waits for your response. You can suppress all these massages and the pause associated with them by specifying /Y in the command string.

A.4.2.11 The Directory Initialization Option (/Z[:n])

You must initialize a device before you can store files on it. Use the /Z option to clear and initialize the directory of an RT-11 directory-structured device. The /Z operation must always be the first operation you perform on a new device after you receive it, formatted, from a manufacturer. After you use /Z, there are no files in the directory.

The syntax of the command is as follows:

```
device:/Z[:n]
```

In this command, the optional argument, n, is an octal number (greater than or equal to 1) indicating the change in size of each directory entry on a directory-structured device. The size of the directory determines the number of files that can be stored on a device. The system allows a maximum of 72 files per directory segment, and 31 directory segments per device. Each segment uses two blocks of available disk space. If you do not specify n, each entry is seven words long (for file name, creation date, and file length information). When extra words are allocated, the number of entries per directory segment decreases. The formula for determining the number of entries per directory segment is:

```
512-7/((# of extra words) +7)
```

For example, if you use /Z:1, you can make 63 entries per segment. RT-11 does not normally support non-standard directory formats. DIGITAL does not recommend altering the directory format. The number of directory segments in the directory defaults to the decimal value shown in Table A-7 for the specified device.

Table A-7 Default Directory Sizes

Device	Size (decimal) of Directory in Segments
RK	16
DT	4
RF	4
DS	4
DP	31
DX	4
DM	31
DY	4
DL	16

A.4.2.11.1 Changing Directory Segments (/N:n)

If you do not want the default size of the device, use /N with /Z to set the number of directory segments for entries in the directory. The syntax of the command is as follows:

```
/N:n
```

In this command, n represents the number of directory segments; n is an integer in the range 1-31.

The following example initializes the directory on device RK1: and allocates six directory segments.

```
*RK1:/Z/N:6

RK1:/Init are you sure?Y
```

A.4.2.11.2 Storing Volume ID (/V)

When you initialize a disk or magtape, DUP stores a default device ID of RT11A in block 1 of the device. You can use the /V option with /Z to insert a user ID and owner name in block 1 of the device. For example, the following command initializes device RK1: and prompts you for a volume ID and owner name. Section 8.2.8 illustrates these prompts and shows how to respond to them.

```
*RK1:/Z/V
RK1:/Init are you sure?Y
VOL ID? VOUCHERS
OWNER NAME? PAYABLES
```

A.4.2.11.3 Replacing Bad Blocks (/R[:RET])

You can use the /R option with /Z if the device being initialized is an RK06, RK07, or RL01. If DUP finds any bad blocks, it builds a replacement table of good blocks for them. The replacemement table is stored in words 0-63 of block 1. (/R supports up to 32 bad blocks for the RK06/07, and up to 10 bad blocks for the RL01). The disk then appears to have no bad blocks. Files that span the bad block use a replacement block instead of the bad block. The replacement blocks are located in the last cylinder of the disk. Speed of input and output operations decreases only when the replacement blocks for bad blocks are accessed. You can avoid this overhead by using the /B option (see Section A.4.2.11.4) and not using bad block replacement. If DUP finds any bad blocks in a non-replaceable part of the disk, DUP reports that the disk is bad. When you initialize a device and want to retain the bad block replacement table that was created by a previous /R command, use /R:RET. The /R:RET option makes it easy to reinitialize a disk without rescanning it. After a disk is initialized with the /Z/R option combination, a scan of the disk with /K should reveal no bad blocks. If DUP finds a bad block during the /Z/R operation that is in blocks 0 through 5, it reports that the disk is not usable. If DUP finds a bad block that is not already marked on the disk as such, it prints the ?DUP-W-UNMARKED BAD BLOCK message. This disk is not usable and must be reformatted by the manufacturer. If DUP finds bad blocks in the device directory, it prints a warning message. Bad blocks in the directory can cause considerable overhead and slow system performance on ENTER,LOOKUP, and CLOSE operations.

A.4.2.11.4 Covering Bad Blocks (/B)

To scan the disk for bad blocks and write files over them, use the /B option with /Z. For every bad block DUP encounters on the device, it creates a file called FILE.BAD to cover it. After the disk is initialized and the scan completed, the directory consists only of file FILE.BAD entries that cover the bad blocks. If DUP finds a bad block in the boot block or the directory, it prints an error message and the disk is not usable.

/R and /B are mutually exclusive options. You can use one or the other, but not both.

A.5 THE DIRECTORY PROGRAM (DIR)

DIR can list directory information about a specific device, such as the number of files stored on the device, the file names and their creation dates. DIR. It can also list details describing individual files, including file name, file type and the number of blocks in the file. Finally, it can organize its listing in several ways, including alphabetically and chronologically.

A.5.1 Calling and Using DIR

To cal DIR from the system device, respond to the dot (.) printed by the keyboard monitor by typing:

R DIR (RET)

The Command String Interpreter prints an asterisk at the left margin of the terminal and waits for you to enter a command string. If you enter only a carriage return in response to the asterisk, DIR prints its current version number. You can type CTRL/C to halt DIR and return control to the monitor when DIR is waiting for input from the console terminal. You must type two CTRL/Cs to abort DIR at any other time. To restart DIR, type R DIR or REENTER in response to the monitor's dot. Chapter 6, Command String Interpreter, describes the general syntax of the command line that DIR accepts. Unless otherwise indicated, numeric arguments are interpreted as octal. Remember to put a decimal point after a decimal number to distinguish it from an octal number. Some of the DIR options accept a date as an argument in the command line The syntax for specifying the date is:

dd.:mmm:yy.

where

dd.	represents the day (a decimal integer in the range 1-31).
mmm	represents the month (the first three characters of the name of the month).
yy.	represents the year (a decimal integer in the range 73-99).

You can specify only one input device and one output device, but you can specify up to six file names on the input device. The default device for output is the terminal. The default file type for an output file is .DIR. The default device for input is DK:. If you omit the input specification completely, DIR uses DK:*.*. If you do not supply an option, DIR performs the /L operation. Note that wildcards are valid with DIR for the input specification only.

Directory listing normally print on the terminal in two columns. Read the entries across the columns, moving from left to right, one row at a time. Directory listings that are sorted, however, are an exception to this. (Sorted directories are produced by /A,/R, and /S). Read these listings by reading the left column from top to bottom, then reading the right column from top to bottom.

A.5.2 DIR Options

You can perform many different directory operations by specifying options in the DIR command line. Table A-8 summarizes the operations these options permit you to perform with DIR. The following sections describe the various DIR options and give examples that use the options. The sections are arranged alphabetically by option.

Table A-8 DIR Options

Option	Section	Explanation
/A	A.5.2.1	Lists the directory of the device you specify in alphabetical order by file name and type (this is the same as /S:NAM).
/B	A.5.2.2	Lists the directory of the device you specify, including file names and types, creation dates, starting block number in decimal, and the number of blocks in each file. For magtape, the starting block number is the file sequence number.
/C:n	A.5.2.3	Lists the directory in n columns; n is an integer in the range 1-9. The default value is two columns for normal listings and five columns for abbreviated listings.
/D[:date]	A.5.2.4	Includes in the directory listing only those files with the date you specify. If you do not supply a date, DIR uses the system's current date.
/E	A.5.2.5	Lists the device directory including unused spaces and their sizes. An empty space on a cassette directory represents a deleted file.
/F	A.5.2.6	Prints in five columns a short directory (file names and types only) of the device you specify.
/G	A.5.2.7	Lists the file you specify and all files that follow it in the directory. This option does not list any files that precede the file you specify.

Table A-8 DIR Options (CONT.)

Option	Section	Explanation
/J[:date]	A.5.2.8	Prints a directory of the files created on or after the date you specify. If you do not supply a date, DIR uses the system's current date.
/K[:date]	A.5.2.9	Prints a directory of files created before the date you specify. If you do not supply a date, DIR uses the system's current date.
/L	A.5.2.10	Lists the directory of the device you specify including the number of files, their dates, and the number of blocks each file occupies. (This is the default operation).
/M	A.5.2.11	Lists a directory of unused areas of the device you specify.
/N	A.5.2.12	Lists a summary of the device directory.
/O	A.5.2.13	Similar to /L but lists the sizes and block numbers of the files in octal.
/P	A.5.2.14	Prints a directory of the device you specify, excluding the files you list.
/Q	A.5.2.15	Lists a directory of the device you specify, listing the file names and types, sizes, creation dates and starting block numbers of files that have been deleted and whose file name information has not been destroyed.
/R	A.5.2.16	Lists the files in the reverse order of the sort specified with /A or /S.
/S[:xxx]	A.5.2.17	Lists the directory of the device you specify in the order you specify; xxx indicates the order in which DIR sorts the listing (xxx can be DAT, NAM,POS,SIZ, OR TYP).
/V	A.5.2.18	Lists the volume ID and owner name as part of the directory listing header.

A.5.2.1 The Alphabetical Option (/A)

The /A option lists the directory of the device you specify in alphabetical order by file name and type. It has the same effect as the /S:NAM option. The following example lists the directory of device DX0: in alphabetical order on the terminal.

```
*DX0:/A
 13-Apr-77
DIR   .SAV    16 15-Mar-77     LP    .SYS     2 01-Mar-77
DT    .SYS     2 01-Mar-77     MACRO .SAV    46 01-Mar-77
DUP   .SAV    17 04-Mar-77     PID   .SAV    16 16-Mar-77
DXMNSJ.SYS    91 01-Mar-77     SYSMAC.MAC    27 18-Feb-77
EDIT  .SAV    21 01-Mar-77     TT    .SYS     2 01-Mar-77
LINK  .SAV    25 01-Mar-77
 11 Files, 265 Blocks
 215 Free Blocks
```

A.5.2.2 The Block Number Option (/B)

The /B option prints a directory of the device you specify and includes the starting block number in decimal of all the files listed. The following example lists the directory of device DX0:, including the starting block numbers of files.

```
* DX0:/B
 13-Apr-77
DXMNSJ.SYS    91 01-Mar-77     14     TT    .SYS     2 01-Mar-77   105
LP    .SYS     2 01-Mar-77    107     DT    .SYS     2 01-Mar-77   109
EDIT  .SAV    21 01-Mar-77    111     LINK  .SAV    25 01-Mar-77   132
DUP   .SAV    17 04-Mar-77    157     DIR   .SAV    16 15-Mar-77   174
PIP   .SAV    16 16-Mar-77    190     MACRO .SAV    46 01-Mar-77   206
SYSMAC.MAC    27 18-Feb-77    252
 11 Files, 265 Blocks
 215 Free blocks
```

A.5.2.3 The Columns Option (/C:n)

The /C[:n] option lists the directory in the number of columns you specify. The argument, n, represents an integer in the range 1-9. If you do not use the /C:n option, DIR lists the directory in two columns for normal listings and five columns for abbreviated listings. The following command, for example, lists on the terminal the directory of device DX1: in one column.

```
*DX1:/C:1
 13-Apr-77
FORTRA.SAV     191 28-Feb-77
BASIC .SAV      51 25-Feb-77
SYSLIB.OBJ     200 31-Mar-77
 2 Files, 442 Blocks
 38 Free blocks
```

A.5.2.4 The Date Option (/D[:date])

The /D[:date] option includes in the directory listing only those files with the date you specify. The default date is the system's current date. For example, the following command lists on the terminal all the files that were created on 1 March 1977.

```
*DX0:/D:01.:MAR:77.
 13-Apr-77
DXMNSJ.SYS    91 01-Mar-77     TT      .SYS    2 01-Mar-77
LP    .SYS     2 01-Mar-77     DT      .SYS    2 01-Mar-77
EDIT  .SAV    21 01-Mar-77     LINK    .SAV   25 01-Mar-77
MACRO .SAV    46 01-Mar-77
 7 Files, 149 Blocks
 215 Free blocks
```

A.5.2.5 The Entire Option (/E)

The /E option lists the entire directory including the unused areas and their sizes in blocks (decimal). The following example lists on the terminal the entire directory of device DX1:, including unused areas

```
*DX1:/E
 03-May-77
DIR   .SAV    16 08-Apr-77     DUP     .SAV   17 13-Apr-77
ABC   .MAC     4 19-Apr-77     AAF     .MAC    2 19-Apr-77
PIP   .SAV    16 14-Apr-77     COMB    .SAV    4 19-Apr-77
MERGE .FOR     6 24-Apr-77     < UNUSED >    415
 7 Files, 65 Blocks
 415 Free blocks
```

A.5.2.6 The Fast Option (/F)

The /F option lists only file names and file types, omitting file lengths and associated dates. For example, the following command lists on the terminal only file names and types from device DT0:.

```
*DT0:/F
 13-Apr-77
DMPX  .MAC    MATCH .BAS      EXAMP  .FOR   GRAPH   .FOR    SPOOL .MAC
GLOBAL.MAC    PROSEC.MAC      KB     .MAC   EXAMP   .MAC    FIX463.SAV
GRAPH .BAK    DTMNSJ.SYS
 12 Files, 167 Blocks
 397 Free blocks
```

A.5.2.7 The Begin Option (/G)

The /G option lists the directory of the device you specify, beginning with the file you specify and including all the files that follow it in the directory. Usually, the disk you are using as a system device

contains a number of files that the operating system needs. These files include .SYS monitor files, .SAV utility program files, and various .OBJ, .MAC, and .BAT files. They are generally grouped together and usually list at the beginning of a normal device directory. Files that you create and use, such as source files and text files, are also grouped together and follow the operating system files in the directory. If you specify the name of the last system file with the /G in the command line, DIR prints a directory of only those files that you created and stored on the device. The following command, for example, lists the last system file (CT.SYS) and all the user files that follow it.

```
*DX0:CT.SYS/G
 15-Apr-77
CT    .SYS     5 08-Apr-77      TEXT   .TST    18 28-Jan-77
PROG  .BAS     3 15-Apr-77      DMPX   .MAC     3 15-Apr-77
MATCH .BAS     3 15-Apr-77      EXAMP  .FOR     2 15-Apr-77
GRAPH .FOR     2 15-Apr-77      GLOBAL .MAC     2 15-Apr-77
PROSEC.MAC     2 15-Apr-77      KB     .MAC    33 15-Apr-77
EXAMP .MAC     4 15-Apr-77      FIX463 .SAV     2 29-Jul-76
GRAPH .BAK    18 28-Jan-77
 13 Files, 97 Blocks
 199 Free blocks
```

A.5.2.8 The Since Option (J[:date])

The /J[:date] option lists a directory of all files stored on the device you specify that were created on or after the date you supply. The default date is the system's current date. The following command lists on the terminal all files on device DT0: that were created on or after 28 January 77.

```
*DT0:/J:28.:JAN:77.
 13-Apr-77
GRAPH .BAK     18 28-Jan-77     DTMNSJ.SYS     91 01-Mar-77
 2 Files, 109 Blocks
 397 Free blocks
```

A.5.2.9 The before Option (/K[:date])

The /K[:date] option prints a directory of files created before the date you specify. The default date is the system's current date. The following command lists on the terminal all files stored on device DX1: that were created before 15 March 1977.

```
*DX1:/K:15.:MAR:77.
 13-Apr-77
FORTRA.SAV    191 28-Feb-77     BASIC .SAV     51 25-Feb-77
 2 Files, 242 Blocks
 38 Free blocks
```

A.5.2.10 The Listing Option (/L)

The /L option lists the directory of the device you specify. The listing contains the current date, all files and their associated creation dates, the number of blocks used by each file, total free blocks on the device (if disk or DECtape), the number of files listed, and the total number of blocks used by the files. File lengths, number of blocks and number of files are indicated as decimal values. For example, the following command lists on the line printer the directory for device DT

```
*LP:=DX1:/L
```

The line printer output looks like this:

```
 03-MAY-77
DIR   .SAV    16 08-Apr-77     DUP    .SAV   17 13-Apr-77
ABC   .MAC     4 19-Apr-77     AAF    .MAC    2 19-Apr-77
PIP   .SAV    16 14-Apr-77     MERGE  .FOR    6 24-Apr-77
 6 FILES, 61 BLOCKS
 419 FREE BLOCKS
```

A.5.2.11 The Unused Areas Option (/M)

The /M option prints only a directory of unused areas and their size on the device you specify. For example, the following command lists on the terminal all the unused areas on device DK:.

```
*/M
 03-May-77
<UNUSED>     21              <UNUSED>      295
<UNUSED>     16              <UNUSED>      594
 0 Files, 0 Blocks
 926 Free blocks
```

A.5.2.12 The Summary Option (/N)

The /N option prints a summary of the device directory. The following command lists on the terminal the summary of the directory for device D

```
*/N
 13-Apr-77
    72 Files in sesment 1
    72 Files in sesment 2
    72 Files in sesment 3
    12 Files in sesment 4
    16 Available sesments, 4 in use
228 Files, 4141 Blocks
621 Free blocks
```

A.5.2.13 The Octal Option (/O)

The /O option is similar to the /L option, but lists the sizes and starting block numbers (if you use /B) of the files in octal. If the device you specify is magnetic tape or cassette, DIR prints the sequence number in octal. For example, the following command lists on the terminal the directory of device DX0:, with sizes in octal.

```
*DX0:/O
 13-Apr-77 Octal
DXMNSJ.SYS    133 01-Mar-77     TT     .SYS   2 01-Mar-77
LP    .SYS      2 01-Mar-77     DT     .SYS   2 01-Mar-77
EDIT  .SAV     25 01-Mar-77     LINK   .SAV  31 01-Mar-77
DUP   .SAV     21 04-Mar-77     DIR    .SAV  20 15-Mar-77
PIP   .SAV     20 16-Mar-77     MACRO  .SAV  56 01-Mar-77
SYSMAC.MAC     33 18-Feb-77
 11 Files, 411 Blocks
 327 Free blocks
```

A.5.2.14 The Exclude Option (/P)

The /P option lists a directory of all files on a specific device, excluding those that you list. You can specify up to six file specifications.

```
*DX1:*.SAV/P
 03-May-77
ABC   .MAC     4 19-Apr-77      AAF    .MAC   2 19-Apr-77
MARGE .FOR     6 24-Apr-77
 3 Files, 12 Blocks
 419 Free blocks
```

This command lists on the terminal all files on device DX1: except .SAV files.

A.5.2.15 The Deleted Option (/Q)

The /Q option lists a directory of the device you specify, listing the file names, types, sizes, creation dates, and starting block numbers in decimal of files that have been deleted but whose file name information has not been destroyed. The file names that print represent either tentative files or files that have been deleted. This can be useful in recovering files that have been accidentally deleted. Once you identify the file name and location, you can use DUP to rename the area. See Section A.4.2.1 for this procedure.

```
*DISK.DIR=/Q
```

This command creates a file called DISK.DIR on device DK: that contains directory information about unused areas from device DK:.

Use the monitor TYPE command to read the file:

```
.TYPE DISK.DIR/LOG
 Files copied:
DK:DISK.DIR            to TT:
 03-May-77
EDIT   DEM       21 03-May-77    3843   DUM   .       295 03-May-77  3882
DEMOF1.OBJ       16 26-Apr-77    4179   DISK  .DIR    297 03-May-77  4206
SCOPE .PIC      297 03-May-77    4503
 0 Files, 0 Blocks
 0 Free blocks
```

A.5.2.16 The Reverse Option (/R)

The /R option lists a directory in the reverse order of the sort you specify with the /A or /S option.

```
*DX0:/S:DAT/R
 13-Apr-77
PIP    .SAV    16 16-Mar-77     LINK   .SAV   25 01-Mar-77
DIR    .SAV    16 15-Mar-77     LP     .SYS    2 01-Mar-77
DUP    .SAV    17 04-Mar-77     MACRO  .SAV   46 01-Mar-77
DT     .SYS     2 01-Mar-77     TT     .SYS    2 01-Mar-77
DXMNSJ.SYS     91 01-Mar-77     SYSMAC .MAC   27 18-Feb-77
EDIT   .SAV    21 01-Mar-77
 11 Files, 265 Blocks
 215 Free blocks
```

This command lists on the terminal the directory of device DX0: in reverse chronological order.

A.5.2.17 The Sort Option (/S[:xxx])

The /S[:xxx] option sorts the directory of the specified device accordin to a 3-character code you specify with :xxx. Table 9-2 summarizes the codes and their functions.

Table A-9 Sort Codes

Code	Explanation
DAT	Sorts the directory chronologically by creation date. Files that have the same date are sorted alphabetically by file name and file type.
NAM	Sorts the directory alphabetically by file name. Files that have the same file name are sorted alphabetically by file type (this has the same effect as the /A option).
POS	Lists the files in order by their position on the device. This is the same as using /S with no code.
SIZ	Sorts the directory based on file size in blocks. Files that are the same size are sorted alphabetically by file name and file type.
TYP	Sorts the directory alphabetically by file type. Files that have the same file type are sorted alphabetically by file name.

The following examples illustrate the /S option.

```
*DX0:/S:DAT
 13-Apr-77
SYSMAC.MAC      27 18-Feb-77    MACRO .SAV      46 01-Mar-77
DT    .SYS       2 01-Mar-77    TT    .SYS       2 01-Mar-77
DXMNSJ.SYS      91 01-Mar-77    DUP   .SAV      17 04-Mar-77
EDIT  .SAV      21 01-Mar-77    DIR   .SAV      16 15-Mar-77
LINK  .SAV      25 01-Mar-77    PIP   .SAV      16 16-Mar-77
LP    .SYS       2 01-Mar-77
 11 Files, 265 Blocks
 215 Free blocks


*DX0:/S:NAM
13-Apr-77
DIR   .SAV      16 15-Mar-77    LP    .SYS       2 01-Mar-77
DT    .SYS       2 01-Mar-77    MACRO .SAV      46 01-Mar-77
DUP   .SAV      17 04-Mar-77    PIP   .SAV      16 16-Mar-77
DXMNSJ.SYS      91 01-Mar-77    SYSMAC.MAC      27 18-Feb-77
EDIT  .SAV      21 01-Mar-77    TT    .SYS       2 01-Mar-77
LINK  .SAV      25 01-Mar-77
 11 Files, 265 Blocks
 215 Free blocks


*DX0:/S:POS
 13-Apr-77
DXMNSJ.SYS      91 01-Mar-77    DUP   .SAV      17 04-Mar-77
TT    .SYS       2 01-Mar-77    DIR   .SAV      16 15-Mar-77
LP    .SYS       2 01-Mar-77    PIP   .SAV      16 16-Mar-77
DT    .SYS       2 01-Mar-77    MACRO .SAV      46 01-Mar-77
EDIT  .SAV      21 01-Mar-77    SYSMAC.MAC      27 18-Feb-77
```

```
LINK  .SAV     25 01-Mar-77
 11 Files, 265 Blocks
 215 Free blocks


*DX0:/S;TYP
 13-Apr-77
SYSMAC.MAC     27 18-Feb-77    PIP   .SAV     16 16-Mar-77
DIR   .SAV     16 15-Mar-77    DT    .SYS      2 01-Mar-77
DUP   .SAV     17 04-Mar-77    DXMNSJ.SYS     91 01-Mar-77
EDIT  .SAV     21 01-Mar-77    LP    .SYS      2 01-Mar-77
LINK  .SAV     25 01-Mar-77    TT    .SYS      2 01-Mar-77
MACRO .SAV     46 01-Mar-77
 11 Files, 265 Blocks
 215 Free blocks


*DX0:/S:SIZ
13-Apr-77
DT    .SYS      2 01-Mar-77    EDIT  .SAV     21 01-Mar-77
LP    .SYS      2 01-Mar-77    LINK  .SAV     25 01-Mar-77
TT    .SYS      2 01-Mar-77    SYSMAC.MAC     27 18-Feb-77
DIR   .SAV     16 15-Mar-77    MACRO .SAV     46 01-Mar-77
PIP   .SAV     16 16-Mar-77    DXMNSJ.SYS     91 01-Mar-77
DUP   .SAV     17 04-Mar-77
 11 Files, 265 Blocks
 215 Free blocks
```

A.5.2.18 The Volume ID Option (/V)

The /V option prints the device's volume identification and owner name as part of the directory listing header. You can combine /V with any other option.

```
*DX:/V
 29-Nov-77
 Volume ID: FORTRAN VOL
 Owner    : JOYCE
FORTRA.HLP      5 13-Aug-77    FORTRA.SAV    209 13-Nov-77
TT    .SYS      2 14-Aug-77    LP    .SYS      2 14-Aug-77
PIP   .SAV     16 14-Aug-77    DUP   .SAV     17 14-Aug-77
DXMNSJ.SYS     86 14-Aug-77    DIR   .SAV     17 14-Aug-77
DEMOF1:FOR      2 28-Jan-77
 9 Files, 356 Blocks
 130 Free blocks
```

The command shown above lists a directory of DX:. It prints the volume ID and owner name as part of the header.

APPENDIX B

APPENDIX B
ON-LINE EDITING MENUS

This appendix presents stand alone expanded menus for the operator who is familiar with the SD1200 system. These menus summarize on-line editing procedures and provide a ready reference for the experienced operator. Refer to paragraph 3.7.5 (ON-LINE EDITING) for a detailed discussion of these menus and the various data and control parameters that can be displayed and/or edited via the system graphics terminal.

Table B-1. Master Menu (70)

DISPLAY SWITCH SETTING	MENU
70	Master Menu
71	Data Menu
72	Test Parameter Dialog Menu
73	Plotter Calibration Menu
74	Profile Modification Menu
75	Two Point Profile Modification Menu
76	Data Cursor Control Menu
77	Data Disk Directory Menu
78	Test Setup Menu
79	All Menus
80	Stop Code List

Table B-2. Data Menu (71)

SWITCH SETTINGS			DATA DISPLAYED
FUNCTION SWITCH 1	ENTER DATA SWITCH 2	DISPLAY SWITCH 3	To activate display make switch settings 1, 2, and 3; then toggle DISPLAY/STORE switch to the DISPLAY position.
--------	01-99	00	Power Spectral Density of selected input channel *
--------	-----	01	Standard Spectrum Profile
--------	-----	02	Drive Spectrum Profile
--------	-----	03	Error Spectrum ** (Control Spectrum Standard Spectrum)
--------	-----	04	Time Domain Drive Signal (± 3 max amplitude deviation)
01-99	01-99	05	Power Transmissibility *** (ED BS, ED BD or ED SR)
01-99	01-99	06	Amplitude Transmissibility *** (ED BS, ED BD or ED SR)
	01-99	07	Stored Response

* Set ENTER DATA switch to the SD401 channel number of the desired input.

** Control Spectrum is the output of the control accelerometer or other reference source: i.e., averaged inputs.

*** Where ED = Input from SD401 Channel Selector.

BS = Standard Spectrum; BD = Drive Spectrum; SR = Stored Response as selected from the Plotter Calibration Menu.

Function switch setting will determine SR selected.

Table B-3. Test Parameter Dialog Menu (72)

SWITCH SETTINGS			PARAMETER DISPLAYED
FUNCTION SWITCH 1	ENTER DATA SWITCH 2	DISPLAY SWITCH 3	To activate the display, set switches 1, 2, and 3; toggle the DISPLAY/STORE switch to DISPLAY *
10	------	10	Degrees of Freedom
11	------	11	OVERTEST Limit
12	------	12	Undertest Limit
13	------	13	Number of Pretest Levels
14	01-04	14	Values of Pretest Levels
15	------	15	Start Level in -dB.
16	------	16	Minimum Equalization tolerance (dB).

* To modify a parameter: Set switches 1, 2, 3 and toggle DISPLAY/STORE switch to DISPLAY with the desired parameter displayed, use the ENTER joystick to increase or decrease the value. Toggle the DISPLAY/STORE switch to STORE to enter the modified value.

Table B-4. Data Cursor Control Menu (76)

SWITCH SETTINGS			PARAMETER DISPLAYED
FUNCTION SWITCH 1	ENTER DATA SWITCH 2	DISPLAY SWITCH 3	To activate display, set switches 1 and 3: toggle DISPLAY/STORE to to DISPLAY.
50	--------	50	Frequency data appears on COMPUTER RESPONSE readout; plotter pen is at cursor location.
51	--------	51	Amplitude data appears on COMPUTER RESPONSE readout; plotter pen is at cursor location.

Table B-5 Test Setup Menu (78)

SWITCH SETTINGS			DATA DISPLAYED
FUNCTION SWITCH 1	ENTER DATA SWITCH 2	DISPLAY SWITCH 3	To activate the display, make switch settings 2 and 3, then toggle DISPLAY/STORE switch to DISPLAY position.
00	01-99	--------	Select a test number
01	01-99	--------	Change the test number while in RUN mode.
02	01-99	--------	Set SD401 Channel Sensitivity. (Computer will request mV/g via terminal).
03	01-99	--------	Perform, display, and store a spectral analysis of the selected input as the external reference.

Table B-6 Test Profile Modification Menu (74)

SWITCH SETTINGS			PARAMETER DISPLAYED
FUNCTION SWITCH 1	ENTER DATA SWITCH 2	DISPLAY SWITCH 3	To activate the display, set switches 1 and 3; toggle the DISPLAY/STORE switch to DISPLAY
30	--------	30	g/Hz level at cursor location on REFERENCE SPECTRUM
31	--------	31	Upper tolerance limit in dB at cursor location
32	--------	32	Lower tolerance limit in dB at cursor location
33	--------	33	Upper abort limit in dB at cursor location
34	--------	34	Lower abort limit in dB at cursor location
35	--------	35	Frequency in Hz at cursor location
36	--------	36	Standard Spectrum grms level

Table B-7 Plotter Calibration Menu (73)

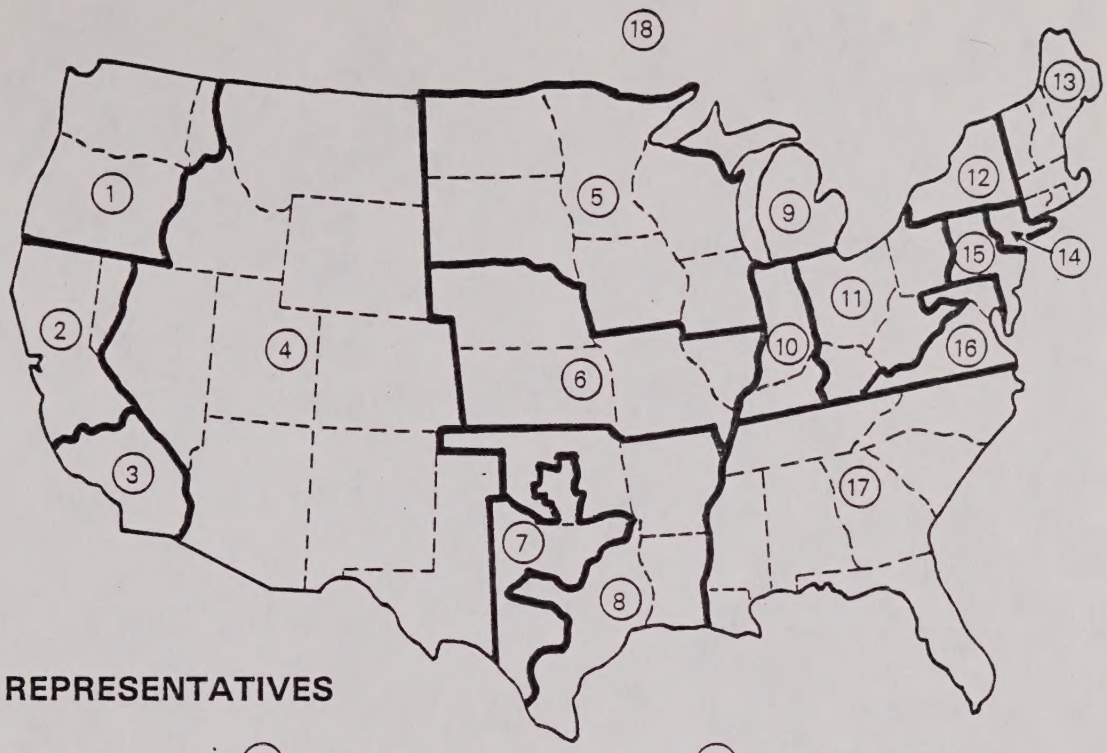
SWITCH SETTINGS			PARAMETER DISPLAYED
FUNCTION SWITCH 1	ENTER DATA SWITCH 2	DISPLAY SWITCH 3	To activate the display, set switches 1, 2, and 3; toggle the DISPLAY/STORE switch to DISPLAY
20	--------	20	PLOTTER CALIBRATION
21	--------	21	GRAPHICS DISPLAY MODE
22	--------	22	Max amplitude SPAN (in dB)
23	--------	23	MINIMUM ZOOM frequency
24	--------	24	MAXIMUM ZOOM frequency
25	--------	25	Full-scale PSD amplitude level g/Hz
26		26*	Transmissibility Reference
			NOTE: Expand Frequencies determine the portion of the Spectrum produced in the Expand Modes

Table B-8 Data Disk Directory Menu (77)

SWITCH SETTINGS			DISPLAY
FUNCTION SWITCH 1	ENTER DATA SWITCH 2	DISPLAY SWITCH 3	To activate display, set switches 1, toggle DISPLAY/STORE switch to DISPLAY.
--------	--------	60	Listing of test files stored on the Data Disk
--------	--------	61	Listing of current test's stored Data.

Table B-9 Two-Point Profile Modification Menu (75)

SWITCH SETTINGS			PARAMETER DISPLAYED
FUNCTION SWITCH 1	ENTER DATA SWITCH 2	DISPLAY SWITCH 3	1 to activate the display, set switches 1 and 2; toggle the DISPLAY/STORE switch to DISPLAY. The parameter value at the left cursor location will appear. To display the value of the right-hand cursor location, toggle the DISPLAY/STORE switch to STORE; then toggle it to DISPLAY.
40	--------	40	(a) g level at left-hand cursor location on STANDARD SPECTRUM. (b) G level at right-hand cursor location on STANDARD SPECTRUM.
41	--------	41	(a) Upper tolerance limit dB level at left-hand cursor location. (b) Upper tolerance limit dB level at right-hand cursor location.
42	--------	42	(a) Lower tolerance limit dB level at left-hand cursor location. (b) Lower tolerance limit dB level at right-hand cursor location.
43	--------	43	(a) Upper abort limit dB level at left-hand cursor location. (b) Upper abort limit dB level at right-hand cursor location.
44	--------	44	(a) Lower abort limit dB level at left-hand cursor location. (b) Lower abort limit dB level at right-hand cursor location.
45	--------	45	(a) Frequency (Hz) at left-hand cursor location. (b) Frequency (Hz) at right-hand cursor location.



NATIONAL REPRESENTATIVES

(1) **BRETT ASSOCIATES**
Seattle, Washington 98116
(206) 935-8054

(2) **SPECTRAL DYNAMICS**
NORTHERN CALIFORNIA
DISTRICT OFFICE
Santa Clara, California 95051
(408) 733-0602

(3) **SPECTRAL DYNAMICS**
LOS ANGELES DISTRICT OFFICE
Santa Fe Springs, California 90670
(213) 949-9421

(4) **R.A. MAYES COMPANY**
Albuquerque, New Mexico 87192
(505) 292-2330

Phoenix, Arizona 85014
(602) 279-5243

Denver, Colorado 80204
(303) 893-2264

(5) **BERNDT ASSOCIATES**
Chicago, Illinois 60646
(312) 283-0713

Milwaukee, Wisconsin 53227
(414) 545-8400

Minneapolis, Minnesota 55427
(612) 546-2021

(6) **ADELPHI, INC.**
St. Louis, Missouri 63131
(314) 821-1232

(7) **CAREY-WOLF & ASSOCIATES, INC.**
Ft. Worth, Texas 76116
(817) 461-7333 (METRO)

(8) **SPECTRAL DYNAMICS/DYMAC**
HOUSTON OFFICE
Houston, Texas 77058
(713) 486-1460

(9) **SPECTRAL DYNAMICS**
DETROIT OFFICE
Southfield, Michigan 48075
(313) 569-5111

(10) **TRI-STATE TECHNICAL SALES**
Indianapolis, Indiana 46205
(317) 924-3568

(11) **SPECTRAL DYNAMICS**
CLEVELAND OFFICE
Cleveland, Ohio 44122
(216) 752-7383

(12) **D.B. ASSOCIATES, INC.**
DeWitt (Syracuse), New York 13214
(315) 446-0220

(13) **NORTHEAST ENGINEERING, INC.**
Hamden, Connecticut 06518
(203) 248-4481

Danvers, Massachusetts 01923
(617) 774-3010

(14) **SPECTRAL DYNAMICS**
NEW JERSEY OFFICE
(15) Fair Lawn, N.J. 07410
(201) 791-5700

(16) **SPECTRAL DYNAMICS**
WASHINGTON AREA
DISTRICT OFFICE
Riverdale, Maryland 20840
(301) 779-5580

(17) **SPECTRAL DYNAMICS**
ATLANTA OFFICE
Atlanta, Georgia 30339
(404) 449-2530

(18) **ASSOCIATED TEST EQUIPMENT LTD.**
Scarborough, Ontario M1W 2S7
(416) 497-2208

Ottawa, Ontario K2A 1C7
(613) 728-3717

Montreal, Quebec H4B 2M8
(514) 481-7733

Vancouver, BC V6H 1E3
(604) 734-2012

Calgary, Alberta T2A 5H7
(403) 230-1697

Scientific-Atlanta
Spectral Dynamics

P.O. Box 671 • San Diego, CA 92112 • (714) 268-7100 • TWX 910-335-2022

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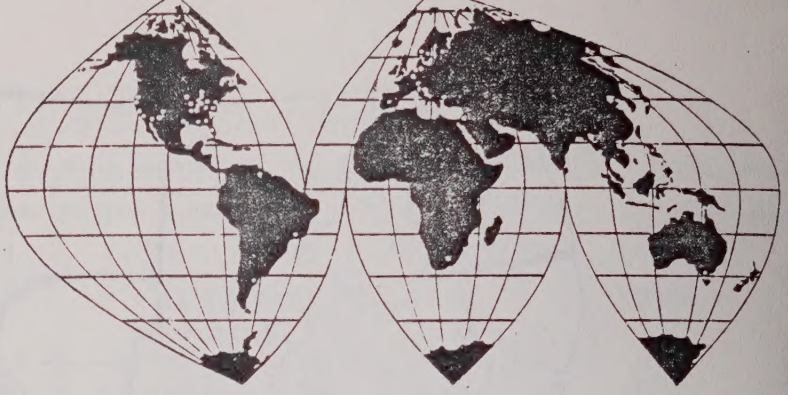

INTERNATIONAL REPRESENTATIVES

ARGENTINA
ARO S.A.I.C.
C de Correo 5681
Belgrano 369
1092 Buenos Aires, Argentina
Telephone: 30-8278
Telex: 17268 ARO AR

AUSTRALIA
VIPAC & PARTNERS PTY. LTD.
30-32 Claremont Street
South Yarra, Victoria 3141
Australia
Telephone: 240 8471
Telex: AA32111

BELGIUM AND LUXEMBOURG
EQUIPEMENT ELECTRONIQUE
Chaussee de Vleurgat, 184
1050 Bruxelles, Belgium
Telephone: (02) 647.06.13
Telex: 22781 EQTRON B

BRAZIL
AROTEC S.A. Industria e Commercio
Av. Pacaembu 811
01234 Sao Paulo, Brazil
Telephone: 826-2266
Telex: 1122207 AROT BR

CHILE
TECNOLOGIA INDUSTRIAL
Sanchez Fontecilla 646
Dept. D
Casilla 16037
Santiago 9, Chile
Telephone: 481348
Telex: 260 TIAR

DENMARK
SC METRIC A/S
Skodsborgvej 305
DK-2850 Naerum
Denmark
Telephone: (02) 80 42 00
Telex: 37163 METRIC DK

ENGLAND
SPECTRAL DYNAMICS — U.K. BRANCH
25 Bury Mead Road
Hitchin, Herts, England SG5 1 RT
Telephone: Hitchin 31101
Telex: 826087 SPCTRL G

FINLAND
FINN METRIC OY
Ahertajantie 6D
Pl. 6, 02101 Tapiola
Finland (Helsinki)
Telephone: 460-844
Telex: 122018 TRIC SF

FRANCE
SCIENTIFIC-ATLANTA, S.A.
129, Avenue Du Marechal Foch
78400 Chatou, France
Telephone: 698-13-43
Telex: 696385 SPECDYN

GERMANY AND AUSTRIA
SCIENTIFIC-ATLANTA GmbH
8 Munchen 83
Albert-Schweitzer Str. 66/3
P.O. Box 83 27 20
West Germany
Telephone: 67 10 44
Telex: 529545 SDYN D

INDIA
PARSRAM AND CO.
Kailas Darshan, Kennedy Bridge
Nana Chowk, Bombay 400007
India
Telephone: 357010
Telex: 0114851 PARS IN

ISRAEL
RACOM ELECTRONICS CO. LTD.
60, Pinkas St.
P.O. Box 21120
Tel-Aviv 61210 Israel
Telephone: 45 31 51
Telex: 33808 RACEL IL

ITALY
SCIENTIFIC-ATLANTA (ITALY) S.p.A.
Via Benedetto Croce 19
00142 Rome, Italy
Telephone: (39) (06) 542-0244
Telex: 612043 MRXROM I

JAPAN
TOYO CORPORATION
(Toyo Tsusho K.K.)
P.O. Box 5014
Tokyo International
Tokyo 100-31
Japan
Telephone: (03) 279-0771
Telex: 02222973 TOYOCO J

KOREA
MS INTERNATIONAL CORPORATION
C.P.O. Box 6780
Seoul, Korea
Telephone: 776-6620
Telex: 24965 MSI PARK

MEXICO
SUXEL, S.A.
Salvador Tia Miron, 216
Mexico 4, D.F.
Telephone: 527-59-80

NETHERLANDS
DYMAC-EUROPE
P.O. Box 329
Oss, The Netherlands
Telephone: 04120-32205
Telex: 50724 DYMAC NL

NORWAY
SAVEN A/S
Helgesens gate 14
Postboks 2111
Grunerlokka, Oslo 5
Norway
Telephone: 02-35-62-50
Telex: 11840 SAVEN N

SAUDI ARABIA
AL-NAJIM SAUDI INTERNATIONAL CO. LTD.
Cr. No. U7329
P.O. Box 1017
Dammam, Saudi Arabia
Telephone: 25427
Telex: 601079 NAJIM SJ

SOUTH AFRICA
HURBARN ELECTRONICS (PTY) LTD.
P.O. Box 3236
Johannesburg, 2000 South Africa
Telephone: 37-3954
Telex: 80180 8-0180SA

SPAIN
AMESA
Martinez Campos, 47
Madrid — 10, Spain
Telephone: 419-86-84
Telex: 44360 RAES E

SWEDEN
SAVEN A/B
Box 49
S-185 00 Vaxholm
Sweden
Telephone: 0764-31580
Telex: 12986 SAVENIC S

SWITZERLAND
VIBRODYN
8113 Boppelsen
Zurich
Switzerland
Telephone: 056/743268
Telex: 53168 TELAG CH

TAIWAN
ALPHA PRECISION INSTRUMENTATION CORP.
12th Floor, Express Bldg.
56 Nan King East Road, Sec. 4
Taipei, Taiwan, R.O.C.
Telephone: (02) 741-2104
Telex: 25138 APIC

Scientific-Atlanta
Spectral Dynamics

United States: P.O. Box 671 • San Diego, CA 92112 • (714) 268-7100 • TWX 910-335-2022
Europe: Horton Manor • Stanwell Road • Horton, Slough • SL3 9PA, England • Colnbrook 3211 • Telex: 849406